I

THE SIGNIFICANCE OF THE VOLUME OF MANUFACTURE

Manufacture, in the sense of factory production, is one of the most significant phases of modern economic life. This fact follows from the extraordinary inclusiveness of modern factory processes. Not so long ago the household spinning wheel and hand loom were important instruments of production; and the local cobbler, with his modest outfit, made such footwear as the community required. But in progressive countries, hand spinning and weaving to-day are lost arts, and the village shoemaker has disappeared. The foundry has displaced the blacksmith and the furniture factory the local cabinet-maker. Even the farmer's butter churn is threatened by the community creamery, and the country housewife depends increasingly upon the village store for her supplies. Fresh milk and fresh vegetables are about the only staple articles of food which now, in general, reach the consumer without being fashioned in some measure in the factory. As for the other goods we consume—our meat, sugar, flour, our clothing, our household conveniences, our means of recreation, not to mention the more complex instruments of communication and transportation upon which our modern life depends so vitally—all are in some measure factory products. It is clear, consequently, that in current manufacture there is afforded a most comprehensive record of the total flow of material goods upon which our economic existence so largely depends.

But it would be a mistake to think that changes in the volume of manufacture invariably reflect corresponding changes in the established flow of economic goods. Changes in the volume of manufacture have their origin in no single underlying factor. On the contrary, a variety of forces are involved. Some of these forces are intermittent or transitory; others sustained or permanent. The nature and importance of all the forces must be carefully considered in any attempt to explain the significance of changes in the volume of manufacture from one period to another.

Changes in industrial output, in the first place, may come about through changes in society's productive capacity. Human and natural resources, industrial technique, political policies, and social institutions combine to give any society a certain capacity for producing economic goods. Owing to the present extraordinary reach of factory processes, the exercise of productive capacity by any

economic society is almost inevitably reflected sooner or later in industrial output. Over substantial periods of time changes in the volume of manufacture, therefore, may safely be ascribed, at least in part, to changes in the underlying productive capacity of society.

At the same time, it should be recognized that some part of an increase of industrial output may represent no enlargement of total capacity, or even of current production, but rather a transfer of productive processes from household or shop to factory. It is customary in these days to think of manufacture in terms of factory production; the farmer's domestic production of butter is not termed "manufacture," though the near-by creamery's production of the same article is. Periods of increasing industrialization, therefore, will show increases of manufacture which do not reflect corresponding increases of productive capacity or of current production, but merely an increasing resort to factory methods.

Furthermore, the volume of manufacture may be affected at times by social projects which for the time being divert large bodies of the workers from manufacturing enterprise. Great wars inevitably have this effect. Not that manufacture is necessarily, or even probably, diminished at such times; on the contrary, extraordinary efforts may fully maintain industrial output. But the primary objectives of war lie on the fighting front. Millions of men in arms means millions of men away from customary occupations in commerce and industry. The volume of manufacture is almost certain to be affected in some measure by such radical redistributions of the Nation's available man power. At times of great national undertakings, therefore, correlative changes in industrial output may reasonably be expected.

Still another type of influence may account for changes in the volume of manufacture. Such changes frequently occur in response to changing general business conditions. Few elements of the business cycle are more characteristic than the ups and downs of factory output. A decline in the volume of manufacture from one year to the next may represent for the most part cyclical slackening of industrial pace; a rapid rise in factory production from one period to another may reflect little more than the acceleration of manufacturing which is characteristic of one phase of the cycle. Changes in the volume of manufacture, therefore, must always be interpreted with due regard to the periodic ups and downs which mark the course of the present competitive order.

From what has been said, it is clear that changes in the volume of manufacture have a significance which is commonly of a highly complex character. Numerous underlying influences may account for the change which occurs in any given period. Fundamentally, however, the general significance of changes in industrial output is clear.

Such changes indicate relative alterations of the total flow of material goods from producer toward consumer.[1]

The fundamental significance of this flow of goods inheres in its physical volume. Measurement of changes in money values will not disclose what are, after all, the basic facts. In other analyses, pecuniary mensuration is commonly indicated. The incentives of competitive enterprise are primarily pecuniary in character; economic motivating forces and other directly correlated factors may properly be measured in money values. But in the examination of the total flow of material goods, incentives to competition are not immediately involved. Rather, material sources of satisfaction are concerned. These sources, in general, are not pecuniary in character. The same things do not give more satisfaction simply because they cost more. We get no more benefit from a loaf of bread when its price is raised. Except for things consumed for purposes of social distinction or prestige, utility is not dependent upon money value. For the bulk of consumers and of consumption, real income is to be measured not in terms of dollars and cents but in terms of goods and services. It is important to know whether consumers are getting more goods and services, not whether they are handling more dollars and cents. The task in the present instance is to measure changes in the physical, not in the pecuniary, volume of manufacture.

Such measurement requires manufacturing records expressed in physical units. Relative changes in industrial output could be traced, it is true, even if the original observations were in monetary terms, provided the value of money were constant, or at most subject to slight or measurable changes. But the value of money never stays precisely the same for any considerable period—at times is subject to radical alteration, even to convulsion—and always is measured with difficulty. The price movements of recent years—unprecedented in range and violence—have made the monetary unit a most uncertain compass with which to chart the economic seas. Over the physical elements which lie at the foundation of our economic life, the widely fluctuating value of money has, in fact, cast a thick pecuniary fog. It has been virtually impossible to translate aggregate values into aggregate quantities. At least for the time being, changes in the values of farm products throw little or no light on changes in the physical size of the crops; changes in the value of imports or exports tell little or nothing about the movement of the physical

[1] This conclusion is not intended to ignore the contributions of other major lines of productive endeavor—agriculture, animal husbandry, forestry, fishing, mining. Clearly, agricultural results may vary from season to season more or less independently of manufacturing activity; and the exploitation of the country's natural resources may proceed at widely varying rates from year to year. But before the raw materials from any source reach the consumer they are almost certain to be fabricated. In manufacture, therefore, the "effective" rate of total material production—that is, the rate which bears fairly directly upon consumer's wants—is made evident.

volume of foreign trade; changes in the value of manufactured products afford practically no information regarding alterations in the physical flow of goods from producer to consumer—that is, regarding society's real income. What is needed at the present time, therefore, is a measurement in physical units of changes in the volume of manufacture.

Fortunately, in factory output there is an exceptional opportunity to observe the total flow of economic goods. To trace the goods in their cruder stages would be much more difficult. The raw materials of manufacture come from an infinite range of sources. The farm and the forest, the quarry and the mine, the lake and the open sea, the pasture and the prairie range—all contribute their share. To catalogue the full run of raw materials from this great diversity of sources would be an almost impossible task. Equal difficulties would be encountered in any attempt to picture the vast stream of finished products as it reaches the ultimate consumer. The forms assumed by the goods, the uses to which they are put, the places to which they are transported, defy complete enumeration. Only in the intermediate stages, between crude material and highly fabricated products, does the flow of goods narrow to measurable limits. Modern industry tends toward physical concentration. In the factory—in other words, in the records of manufacture—is the opportunity to measure changes in the volume of goods flowing continuously into human use.

Such measurement should not be undertaken, however, without recognition at the outset of certain limitations inherently imposed upon the analysis. In the first place, the very concept of changes in the volume of manufacture is illusive. For example, suppose 100,000 pairs of men's shoes are turned out in a certain factory in 1910, and 150,000 in the same factory in 1920. It might appear perfectly obvious that there has been an increase of 50 per cent in the volume of manufacture so far as this particular establishment is concerned. But suppose the 150,000 pairs made in 1920 are essentially higher grade shoes than those produced in 1910. Suppose the shoes of the later year are fashioned from better material; are not as simple in style; are made with better workmanship; are in every respect more highly finished shoes, representing the use of better machinery, the application of more highly skilled labor, and the outlay of more time. Are we still to think of the volume of manufacture in the supposed instance as having increased only 50 per cent?

Probably no other conclusion is practicable. Measurement of the volume of manufacture is at best a crude process. Inevitably it has to deal with the grosser aspects of production. Distinctions which are marked enough to form differences in kind may be recognized; those which are no more than distinctions of quality or grade have to be ignored. It is feasible, for example, to measure separately

changes in the volume of manufacture of book paper and fine paper, but changes in the volume of production of the different grades of each of these varieties of paper can hardly be considered.[2] In general, any measurement of the volume of manufacture is bound to ignore many changes in the degree of fabrication to which materials are subjected. It is certain to rest largely upon notions of bulk; to deal in terms of gross quantities, not in terms of fine qualities. The very illusiveness of the concept of a general rate of growth of manufacture imposes serious limitations upon the analysis.

In the second place, direct measurement of the volume of manufacture is obstructed by lack of statistical data. The multiplicity of manufactured products lies beyond statistical reach. Of necessity, attention is focused upon the limited number of products for which quantity figures are obtainable. The commodities for which production data are at hand are, for the most part, of a simple and staple character. The extent to which they are representative of the full variety of manufactured products is somewhat uncertain. Furthermore, even for these more easily reported articles, the data are by no means as full as they ought to be for satisfactory statistical analysis. It is only recently that the value of statistical records in the industrial field has come to be recognized. Many production records were not begun until governmental supervision during the World War compelled the collection of data. Though an increasing number of production figures are being gathered and published, it will be years before comparable data on manufacturing output are available for a satisfactory proportion of the total possible list.

Determination of the rate of growth of manufactures is made difficult in the third place by a troublesome logical problem in the combination of the varying rates of growth shown by different lines of manufacture. Suppose it is found that during the decade 1909 to 1919 cotton manufacture increased 20 per cent, flour milling 10 per cent, steel production 40 per cent, and automobile production 100 per cent. How are these different rates of growth to be combined in a single figure representing significantly the growth of manufacture for these industries as a whole? It is manifestly impossible to merge the four different kinds of goods into a single aggregate—

[2] In this connection a passage from the introduction to the 1909 report of the census of manufactures may well be quoted:

"The difficulty lies primarily in the fact that the number of different commodities and grades of commodities produced by manufacturing industries is enormous, and in the fact that many of the commodities are not standardized. In some cases there is no uniformity in products at all; each individual article made is unique. Even in industries where articles of similar character are produced in considerable numbers, to obtain quantities for each grade of each commodity would necessitate an immense expenditure of time and money. In fact, entire accuracy and completeness could not be secured with any expenditure, because, in many industries, it would be impossible to obtain a description of each grade of each commodity made by a given establishment sufficiently precise to permit identification thereof with the corresponding product of another establishment, and thus to permit the totalization of articles by grades. It would be still further from the range of possibility to make sure that the descriptions of articles and grades given at one census corresponded exactly with those given at another census." (Thirteenth Census of the United States, Vol. VIII, p. 26.)

yards of cotton cloth, barrels of flour, tons of steel, and thousands of automobiles can not be added. The most natural solution of the problem lies in an averaging of the rates of increase. But if these are to be averaged, are all to be treated as of equal importance? If not—and that they should not be seems in the present stage of analysis to be the only possible conclusion—upon what basis are the different rates of increase to be weighted in obtaining the average rate of increase for all combined?

In general, it may be said that there are two possible bases for weighting the individual rates of increase in obtaining a general rate of increase for manufacture as a whole. These two possible bases are: (1) The value added by manufacture in the industry in question compared with the value added in all industry; and (2) the number of wage earners employed in the industry in question compared with the number employed in all manufacture. Upon the whole, the first of these two possible bases seems preferable in the measurement of the growth of manufacture. As between different industries, the number of wage earners employed is by no means a dependable index of the relative importance of the products turned out. In one line of manufacture, labor may be the principal element in fashioning the product; in a different line of manufacture, machinery may do by far the greater part of the work. Value added in manufacture, upon the other hand, reflects definitely the relative economic significance of the different manufacturing industries. Thus, the fact that the value added in textile manufacture is five times that added in the manufacture of leather justifies the treatment of changes in the volume of textile manufacture as five times as important as changes in the volume of leather manufacture. It should be recognized, however, that any method of weighting the different rates of increase of the several divisions of manufacture in the estimate of the general rate of growth of manufacture is in a sense arbitrary. Weighting the individual rates of increase constitutes one of the most serious difficulties encountered in measuring changes in the physical volume of manufacture.

In the introduction to the report on manufactures in the Thirteenth Census, the following statement appears:

> It would be exceedingly desirable, if practicable, to measure the increase in the output of manufacturing industries, individually and collectively, on the basis of quantities of things produced rather than by values. Were it possible to obtain comparable statistics from census to census as to the quantity of every commodity produced by manufacturing establishments, a general expression of the average quantitative increase in the production of manufactured articles, could be computed. * * * It is quite impossible, however, to obtain complete and comparable statistics of the quantities of manufactured articles produced in different census years so as to furnish a basis for the calculation of the average percentage of increase. In fact, for a large proportion of manufactured

products, the Census Bureau has never found it practicable to call for quantities. * * * It might be possible at future censuses to compute the average increase in quantities for a sufficient number of important manufactured products to give some clew to the general quantitative movement of production, but the data at present available are not sufficient for such a computation even of a rough character.

This conclusion of the census authorities in 1909 constitutes a fair warning against the risks which encompass the task of measuring the physical volume of manufacture. As stated earlier, the difficulties are to be recognized at the outset. They can not be altogether surmounted and will inevitably impair somewhat the significance of the statistical results obtained. In the light of these facts, the present study is to be regarded as a reconnaissance into relatively undeveloped country. No precise final results are to be expected. Nevertheless, in view of the importance of the problem, an explorative study seems worth while. Certainly, on the strength of the provisional results that may be forthcoming, the paths of later development in the field may be traced, and the requirements of additional information definitely indicated.

II

THE SERVICEABLE MEANS OF MEASUREMENT

The difficulties inevitably involved in measurement of the growth of manufacture call for the utilization of every available line of information. The most significant raw data for the purpose come, however, from a single source—the periodic censuses of manufactures taken by the Federal Government. It is upon this census material that the present analysis will depend.

Not all of the census data on manufactures are applicable to this particular inquiry. The Federal censuses cover a large number of different aspects of industrial enterprise in the United States. Data are collected regarding the number of establishments, the character of ownership, the number and classes of persons engaged in manufacturing, prevailing hours of labor, power installed and fuel consumed, value of product and value added to materials by processes of manufacture, materials consumed and goods produced, and expenses incurred. Most of this information casts little light upon the physical volume of production. Items such as expenses incurred, value of products, and value added to materials by processes of manufacture are inapplicable for reasons in part already indicated—primarily on account of extraordinary changes in the value of money, but partly because of duplication among industries in the reporting. Items such as number of establishments, character of ownership, and prevailing hours of labor are essentially irrelevant in an investigation of the general growth of manufacture. Only three lines of census information may be made to serve effectively in the measurement of general industrial expansion. These are (1) data regarding physical quantities of materials consumed or products fabricated in manufacturing establishments, (2) the number of wage earners employed in manufacturing industries, and (3) primary horsepower installed in manufacturing establishments. Information regarding all three of these is expressed in physical terms and is not directly affected by changes in the value of money. It is from these three lines of information, then, that we must seek to ascertain the growth of manufacturing industry in the United States.

Ideally, measurement of the volume of manufacture would rest upon records of the output of a large number of manufactured products, output being measured in each instance in physical terms. Thus, the inquiry would start with records of the production of cotton cloth, suits of men's clothing, loaves of bread, passenger automobiles,

and numerous other articles of widespread use. Combination of a sufficient number of series of this sort would afford the desired measurement of changes in the volume of manufacture.

But the incompleteness of production records suggests resort to other related data. Records of production in physical units may be supplemented with reports of materials consumed in manufacture. Thus the number of bales of raw cotton consumed may be taken to measure the volume of cotton manufacture; and the number of animals slaughtered, the volume of meat production. Of course, combinations of data dealing with products manufactured and materials consumed must be made with careful regard to the underlying relationships. These relationships are not always simple and clear. Obviously, raw-material consumption fails to reflect changes in the degree of fabrication to which the materials are subsequently subjected. Increases in the amount of materials consumed undoubtedly sometimes understate—probably rarely, if ever, overstate—the growth of manufacture. Nevertheless, the records of raw-material consumption are sometimes to be used in combination with the data on products in the measurement of changes in the volume of manufacture.

The data on products and materials are most satisfactorily used if summarized in index numbers. In general, an index number is a number expressing the relative change of a group of related variables. In the present instance, the related variables consist of the different amounts of products fabricated or of materials consumed in manufacture in the several census years. An index of the volume of manufacture must combine these related variables so as to provide a measure of the relative change of the group of variables as a whole.

Fortunately, an index number of precisely this sort has already been set up for the volume of manufacture of the census years 1899, 1904, 1909, and 1914. This index was constructed in 1920 by Prof. Warren M. Persons, with the assistance of Miss Eunice S. Coyle.[1] The index makes exhaustive use of the available census data from 1899 to 1914. It is to be carefully examined in connection with the present study of the growth of manufactures in the United States as disclosed by the census returns.

A quotation from the original explanation of the Harvard census index will serve to indicate the nature of the statistical material employed in constructing the index:

> The series utilized in the construction of our index of physical production for manufacture in 1899, 1904, 1914 consist in the main of data compiled by the Bureau of the Census and published in the Abstract of the Census of Manufactures for 1914. They relate to calendar years, or, in the case of some individual

[1] The index appeared in the Review of Economic Statistics for November, 1920, as a part of Professor Day's more general study of indexes of the physical volume of production. The index will be hereafter referred to as the Harvard census index.

firms, to the "twelve-month periods" ending within the calendar years. The figures which we have selected cover returns only for establishments whose chief business was the industry named. By restricting the data to such establishments it is possible to secure comparability between industries. To secure data comparable from year to year, the census has retained "as far as possible the same form of schedule" throughout, and has also revised its figures for 1899 by excluding neighborhood, household, and hand industries. These industries have not been canvassed since 1904, in which year the inquiry was first limited to establishments operated under the factory system. In view of the precautions taken by the Bureau of the Census, the series relating to manufacture from census to census may be considered fairly homogeneous.

From the various series published in the Abstract of Manufactures two sets were taken—(1) quantities of materials used and (2) quantities of products, having, respectively, a cost or value of not less than $10,000,000 in 1914. A few industries measuring up to this standard under the miscellaneous group, however—ice, musical instruments, etc.—were omitted as too small and heterogeneous a sample. The products transcribed relate to articles manufactured during the year, not to articles sold; and materials refer to amounts used, not to amounts purchased. The nomenclature and classification of the census has been followed in this study.

Where figures on quantity were not reported by the census, but were available elsewhere, the other sources were used. Thus, for metals other than iron and steel, data were taken from Geological Survey and mint reports; for liquors and tobacco, from the Annual Report of the Commissioner of Internal Revenue; and for cane sugar, from the Statistical Abstract.

The methods employed in obtaining the index for each census year from these original data are not difficult to follow. In general, they consisted of reducing each series of items registering output of some product or consumption of some material to percentages of the quantities produced or consumed in the base year, 1909. These relatives were then averaged for each census year, each relative being assigned a weight proportionate to its relative importance in the total list of manufactures. In general, for both industries and groups of industries, these weights were based upon values added by manufacture as reported in the census of 1909.

One of the most difficult phases of this method of constructing the index number has to do with the weighting of the individual series. Specifically, the question in each case is, how far may the particular product turned out, or material consumed, be regarded as more generally representative of the volume of manufacture? To take a concrete case, how far may changes in the production of pig iron be regarded as accurately indicative of changes in the production of iron and steel products in general. Doubtless there are wide variations among the very large number of products of iron and steel, but the question is, how far pig iron is reasonably representative of the group of iron and steel products *as a whole*. The question is fundamental in the construction of any index number of the volume of manufacture.

The question of representativeness arises both in connection with individual industries and entire groups of industries. The Bureau of

the Census always reports its returns from the manufacturing census on a broad classification of manufacturing industries. A natural and significant grouping of industries is to be recognized in the construction of the index of the volume of manufacture. So far as the data permit, an index may be set up for each group of manufacturing industries, as well as for manufacture as a whole.

The Harvard census index "was built up by a process of integration—an orderly development of successively larger elements from smaller components." The exact nature of the process will be clear from extracts taken from the explanation originally accompanying the index:[2]

* * * That manufacture exhibits important subdivisions is generally recognized. The Bureau of the Census presents, as the basis of its classification of manufacturing industries, the following groups of industrial products:

I. Food and kindred products.
II. Textiles and their products.
III. Iron and steel and their products.
IV. Lumber and its remanufactures.
V. Leather and its finished products.
VI. Paper and printing.
VII. Liquors and beverages.
VIII. Chemicals and allied products.
IX. Stone, clay, and glass products.
X. Metals and metal products, other than iron and steel.
XI. Tobacco manufactures.
XII. Vehicles for land transportation.
XIII. Railroad repair shops.
XIV. Miscellaneous industries.

This classification is adopted in the present study. So far as the data permit, an index is set up for each group of manufacturing industries.

Just as manufacture in general is a combination of major groups, so each group is a combination of important individual industries. Thus, in the textile group, we find industries devoted to the manufacture of cotton goods, hosiery and knit goods, woolen and worsted goods, silk goods, carpets and rugs, fur-felt hats, and cordage and twine. An attempt is made to secure indices for all the more important individual industries. The group indices are built up from these.

Still further down the scale, below the indices for individual industries, stand the relatives for particular lines in such industries. Thus, for census years, the industry of "Slaughtering and meat packing," under the group of "Food and kindred products," is represented by four series showing the dressed weight of beeves, calves, sheep, and hogs used in the industry. The index for the "Slaughtering and meat packing" industry in 1899, 1904, 1909, and 1914, rests upon these four lesser series. * * * In a considerable proportion of cases, the indices for individual industries rest upon single commodity series assumed to reflect the course of the industry as a whole. In many cases, however, the indices for individual industries combine, as described, the relatives of particular materials important in the industry.

The manufacturing index thus is built up step by step from smaller elements. Single industry indices are secured from single commodity, or combinations of single commodity, relatives. Indices for important groups of industries are obtained by combining single industry indices. Finally, the index for manufacture as a whole is developed by consolidating the several group indices.

[2] See Edmund E. Day, An Index of the Physical Volume of Production, The Review of Economic Statistics, Vol. II, p. 310.

The Harvard census index covers satisfactorily the census years 1899 to 1914, but is not available for the later period. It has seemed desirable, therefore, to construct an index number of the same general character for the census years 1919, 1921, and 1923. This has been done. For the later years census data on products fabricated have been used exclusively. The method followed in constructing the index from these data differs from that employed in the construction of the Harvard census index in only one important particular—the weights used in the new index instead of being based upon value added in manufacture in a single base year (1909) are in each case based on a compromise of the weights derived from values added by manufacture in the two terminal years of the intercensal period for which the index is computed. Thus, in measuring the increase in the volume of manufacture from 1914 to 1919 the weights attached to the different constituent series are made proportionate to *an average* of the values added by manufacture in both 1914 and 1919. This compromising of the weights effects an improvement in the method of developing index numbers of this general form. Aside from this one modification, the methods employed in obtaining the census index for the later years is identical with that employed in obtaining the Harvard census index for the period 1899 to 1914.[3]

An index of the volume of manufacture based upon records of products fabricated—supplemented where necessary by data on materials consumed—is the best single measure of the growth of manufacture in the United States for the period since 1899. The original Harvard census index combined with the new census index for more recent years seems to afford a satisfactory record of the changing volume of manufacture for various intercensal periods. The major results of the present study rest essentially upon the course traced by the production indexes.

But conclusions drawn from the production indexes are not to be accepted without careful regard for results obtained from other lines of evidence. After all, the indexes of the volume of manufacture rest upon a comparatively small sample of the total list of manufactured products. The use of such incomplete data raises questions regarding the representativeness of the figures. Thus, it is not easy to tell how accurately the production of finished articles of personal wear made from textile fabrics—of which we have practically no records—correspond to the manufacture of textile fabrics, for which fairly satisfactory data are available. Similarly, it is almost impossible to say how closely the output of products made primarily from iron and steel follows the production of these basic materials. There is considerable play between manufacturing enterprise in its different stages, and the correlation of one production series with another is

[3] For a fuller explanation of methods and a detailed description of data used in the index, see Appendix A.

frequently uncertain. Production indexes, resting as they do upon the theory that certain available series are fairly representative of broad divisions of manufacture, are bound to be received with reservations, and must be supported wherever possible by all the supplementary lines of evidence that can be brought to bear.

Of these supplementary lines of evidence, the most important are the reported (1) average number of wage earners employed and (2) amount of primary horsepower installed in manufacturing establishments. Both wage earners and horsepower are presumably only roughly related to physical output. In measurements of the volume of manufacture, they constitute only indirect evidences; but as contrasted with available production data they possess the marked advantage of being approximately complete and general in character. They cover all industry instead of a relatively small sample of the whole. The number of wage earners and amount of primary horsepower are therefore both to be considered in the study of the growth of manufacture.

The nature of the census returns regarding wage earners and primary horsepower must be clearly understood. Consider first the average number of wage earners. The census of manufactures reports the total number of persons engaged in manufacturing establishments. They are classified according to industrial status as employers, salaried employees, and wage earners.[4] The latter class is the only one of substantial significance in connection with the present study. The average number of wage earners employed during each month is reported for each of the 12 months of the census year. In 1899 and 1904 manufacturing concerns were required to estimate the average number employed in each month. Beginning with 1909, however, the forms have provided for the report of the number actually employed on the 15th day of each month or on the nearest representative working-day. In either case the average number employed during the year, determined by taking the average of the results of the 12 months of the year, may be viewed as a fairly dependable measurement of the laboring force actually employed in the establishment during the year.[5]

Undoubtedly, among different industries at the same time and in the same industry at different times, the average number of wage earners may be no criterion of differences in the physical volume of the product. Obviously, some industries make much more extended use of machinery. Labor counts for much more in the manufacture

[4] The classification by which wage earners are separated from other employees has remained unchanged since 1899, so that the data are presumably comparable in this respect for the full period of the present study.

[5] Periods of relative idleness are averaged in with periods of full employment. Thus, if during the first 6 months of the year 100 wage earners are employed regularly and during the remaining 6 months of the year none at all is employed, the average number of wage earners for the year is 50.

of a shoe than in the manufacture of a steel rail. Furthermore, the importance of labor as compared with machinery in any given line may undergo revolutionary changes. Labor-saving devices may be introduced, largely displacing particular types of workmen. It is hardly necessary to urge that caution must be employed in reasoning from changes in the number of wage earners to changes in the physical volume of production. Nevertheless, it seems reasonable to suppose that for broad groups of industries and for most single industries for shorter periods of time, there is a high degree of correlation between the number of wage earners employed and the physical volume of production. In the average number of wage earners, as reported regularly in the census of manufactures, we have, then, a possible basis for estimating the increase or decrease of manufacturing output.

Primary power reported by manufacturing establishments is another index of industrial output. The returns include all primary power, reduced to terms of horsepower. Primary power includes for each establishment not only the power developed on the premises but any power purchased or rented from other concerns. It is to be noted, however, that if power is transformed on the premises, as, for example, in the development of electric current from a water wheel, the horsepower developed is counted only once. The power reported is *primary* in the sense that it is its first appearance in the establishment making the return. Total primary horsepower reported thus represents the full installation of power in manufacturing industry.

It may be reasonably supposed that changes in primary horsepower correspond in some measure to changes in manufacturing output. Presumably, the horsepower is installed for the purpose of operating machinery, which machinery in turn has no purpose but the production of manufactured goods. Any increase in mechanical equipment would tend to be accompanied by an increase in installed power. The two would reflect an expansion of manufacturing capacity which when in normal use would show a corresponding increase in physical output. It should be noted, of course, that reported horsepower is more indicative of productive capacity than of actual production. Furthermore, an increase in primary power may represent factors only indirectly related to output; such as increasing displacement of labor by machinery or more liberal installation of power for a relatively fixed amount of machinery. Nevertheless, in primary horsepower we have another possible basis for estimating changes in the physical volume of manufacture.

In employing these different lines of information regarding manufacturing output—products manufactured or materials consumed, wage earners employed, and primary power installed—the merits and defects of each should be clearly recognized and conclusions from one checked against conclusions from the others, that any differences in

the record may be harmonized as far as possible. In this connection certain points are to be carefully noted.

Data regarding products manufactured or materials consumed presumably understate somewhat the growth of manufacture. Undoubtedly, there is in modern production a tendency toward higher manufacture of the basic materials; in other words, there is a tendency toward increasing fabrication. In an important sense, this is an element in the growth of manufacture. True, it is an element that is hardly subject to accurate statistical measurement, an element that can not be given any substantial recognition in estimates of the growth of manufacture. It is proper, nevertheless, to recognize at the outset that data showing the volume of products manufactured or materials consumed in manufacture are more likely to understate than to overstate the growth of manufacturing output.

Records of the average number of wage earners may similarly be regarded as more likely to understate than to overstate changes in the volume of manufacture. After all, the tendency of modern industry is toward greater efficiency, toward increasing use of machinery and labor-saving devices of every sort, toward increasing production per wage earner. Doubtless this tendency is offset at times by opposition to labor-saving devices, by attempts to standardize output; by concerted effort to "make work." Such movements, however, certainly have not prevented during recent years a general increase in the output per worker. Pressure of competitive enterprise guarantees in the present state of the industrial arts a steady increase of technical efficiency. We may safely conclude that the growth of manufacture has probably exceeded during recent years the increase in the average number of wage earners.[6]

Records of primary horsepower installed, upon the other hand, in many instances probably exaggerate considerably the increase in manufacturing output. Resort to machinery has been relatively more rapid than expansion of output. Even if labor-saving devices are introduced as rapidly as seems practicable, labor remains in the majority of industries a potent factor limiting output. Furthermore, there has probably been a disposition in some industrial establishments to provide power more generously, thus increasing the installation of power for a given body of machinery. Of course, these arguments apply with varying force to different lines of industry, much depending upon the extent to which machinery is employed in the industry and the speed with which manufacturing processes in the particular trade have become increasingly mechanical in nature. Particularly where the technology of the industry has undergone revolution on the engineering side, horsepower is probably most

[6] As will be shown later, the period during and immediately following the World War may have been an exception to this general proposition.

likely to overstate the increase of output. Though we must recognize, then, the wide diversity of prevailing conditions, we may reasonably conclude that increases in primary horsepower considerably overstate the growth of manufacture.

In utilizing data on wage earners and horsepower as indexes of industrial output, certain further points are to be noted. The reported average number of wage earners is the number actually employed during the year. This number is influenced by general business conditions. Periods of depression witness widespread unemployment, the discharge of thousands of employees; boom periods bring employment to all who care to work, to many who, in ordinary times, are only spasmodically employed. Fluctuations in the average number of wage earners on account of the business cycle, however, are probably not as great as the corresponding fluctuations of production; for many concerns, in times of depression, follow the practice of keeping numerous wage earners on the pay roll on a part-time basis, and in periods of industrial activity secure increases of output by running overtime rather than by adding to the number of workers employed. The net effect of these practices is to confine fluctuations in number of wage earners within narrower limits than govern the ups and downs of physical production. It is none the less true that the average number of wage earners is influenced substantially by the ebb and flow of industrial activity. If the census returns are made in a year of depression, the average number of wage earners will not show the full growth of manufacture during the preceding intercensal period.

Primary horsepower obviously does not fluctuate as largely with the business cycle. Once installed, it is reported whether in use or not. If the census returns are made in a year of depression, the amount of primary horsepower will be reduced only to the extent to which new installations, which otherwise would have been made, will have been postponed. Thus, changes in primary horsepower may be influenced somewhat by the industrial conditions at the time of the manufacturing census but are doubtless influenced much less than are changes in the average number of wage earners.

If data on both wage earners and horsepower are to be considered in estimating the growth of manufacture, some method of compounding these indirect lines of evidence may perhaps be adopted. It has already been suggested that recorded changes in the number of wage earners probably understate, and in primary horsepower overstate, the growth of manufacture. An average of the two, then, should more accurately measure growth than either alone. But if the two are to be averaged, number of wage earners is clearly to be assigned greater weight than primary horsepower; for all things considered, changes in the number of wage earners are the most

important indirect evidence regarding changes in the volume of manufacture. Comparisons made of the indirect and direct evidences of growth in a number of individual industries would indicate that changes in physical output in most instances closely approximate an average of the changes in wage earners and horsepower, wage earners being given a weight of three in the average, horsepower a weight of one. In estimating industrial expansion from the indirect evidences, therefore, this weighted average may at times be profitably employed.[7]

Measurement of the growth of manufacture is to be undertaken, then, in the light of all available quantitative data on products and materials, the reported average number of wage earners, and installed primary horsepower. When adequate data are available, measurement may best take the form of an index number of volume, based upon the reports of physical quantities of products actually manufactured during the period of record. Reports of quantities of materials consumed in manufacture may be used as supplementary data for such an index. When the available data are so inadequate as to render inconclusive any index number based directly on production, or when for any other reason it is not feasible to set up directly an index of physical volume, use is to be made of the indirect evidence afforded by the returns of average number of wage earners and of primary horsepower. Together the direct and indirect evidences afforded by the periodic censuses of manufactures make possible certain reasonably dependable estimates of changes in the volume of manufacture in the United States during recent decades. These estimates will be considered in the chapters that follow.

[7] As will appear later, this weighted average is clearly inapplicable to the postwar period.

III

THE GROWTH OF MANUFACTURE—ALL INDUSTRIES COMBINED

Measurement of the growth of manufacture may best be undertaken first for all industries combined. The data to be employed for this purpose are essentially comparable for the seven censuses from 1899 to 1923, inclusive. It is practicable, therefore, to analyze the growth of manufacture for each of the six intercensal periods, 1899–1904, 1904–1909, 1909–1914, 1914–1919, 1919–1921, and 1921–1923, and to follow this by a study of the rate of growth in the full 24-year period 1899–1923. Once this general rate of growth for all manufacture has been ascertained, estimates may be made of differences in the rate of industrial expansion among the various more important lines of manufacturing enterprise. From the entire analysis, ideas may be obtained concerning the cyclical condition of industry in the several census years.

The first task, then, is to measure the change of industrial output from one census year to the next. A uniform mode of statement may wisely be adopted in this connection. If any given census year is regarded as a base, the volume of manufacture in any other census year may be conveniently expressed as a percentage of the volume in the base year. When each census year in turn is made the base, the percentage figure for the next census year states the relative change in the volume of manufacture for the intercensal period. It is these percentage figures, as given by the index of physical production, and shown in Table 2 and on Chart II, that we are now to examine.

Turning to the earliest of the periods under investigation—that from 1899 to 1904—we find manufacturing enterprise expanding in the period of activity which followed the long depression of the middle nineties. Conditions in 1899 were reasonably normal, and they continued so throughout most of the intercensal period 1899 to 1904. The five-year period as a whole might be expected to show a substantial increase in the volume of manufacture. It was the beginning of the period of rapid industrial expansion occurring in this country at the opening of the present century.

The actual increase in the volume of manufacture from 1899 to 1904, as given by the index of the physical volume of production, was 22 per cent. When it is recalled that in 1904 some of the after-effects of the minor reactions of 1903—the so-called dry panic of

that year—were still in evidence, it is clear that the underlying rate of industrial expansion for this period from 1899 to 1904 was probably not less than 4 per cent per annum.

The next intercensal period—that from 1904 to 1909—opened with a year in which conditions were not altogether favorable and closed with a year of marked industrial activity. The relative increase of output for the period as a whole might be expected, therefore, to exceed the relative increase of the period from 1899 to 1904. The index of the volume of manufacture actually shows a rise of 30 per cent. The difference is not so great as to suggest any considerable change in the underlying rate of industrial expansion. But that there was no slackening of the rate is clear enough.

The third intercensal period—that from 1909 to 1914—presents a different situation. As already stated, 1909 was a year of general industrial activity. Nineteen hundred and fourteen, on the other hand, was a year of marked industrial depression. It is not surprising, therefore, to find the relative increase of output for this period much smaller than in either of the two preceding periods. The production index actually reveals an increase of only 6 per cent. There could be no clearer demonstration of the fact that records of the volume of manufacture in different years must be interpreted in the light of the cyclical conditions prevailing at the time returns are secured.

Similar complications affect the records of the quinquennial period from 1914 to 1919. Starting from conditions of marked depression, manufacturing enterprise during this period experienced the phenomenal stimulation of the war period, and in 1919, despite the difficulties of early postwar readjustment, was still maintaining an extraordinary pace. At the same time, labor difficulties were chronic throughout much of the war period and became acute in 1918 and 1919. After the armistice employers complained generally of the inefficiency of the workers. Shortages of raw material also were said to impede production. The period was thus one in which extraordinary influences were at work, some tending toward maximum output, others making such output exceedingly difficult.

The combined effect of this complex of factors is reflected in the production index which for the full five-year period shows an increase of 26 per cent. In view of the fact that the period started in marked depression, the increase is not as great as might have been expected. Certainly there is ample proof that the expansion of industrial output in the United States during the war did not exceed expansions which had previously occurred in times of uninterrupted peace.

Since the war, the census of manufactures has been taken every two years instead of every five years, as previously. The intercensal

periods thereafter are now of only two years duration. It might naturally be thought that the changes in the volume of manufacture from one census to another would have been on this account substantially less than in the earlier quinquennial periods. In reality they have at times been greater.

It has already been stated that 1919 was a year of extended manufacturing effort. Nineteen hundred and twenty-one, in contrast, was a year of acute depression. The tremendous decline of commodity prices in 1920–21 left business temporarily stunned. Production schedules for the time being were reduced to the lowest possible levels. The volume of manufacture in 1921 compared with 1919 showed an actual decrease of 21 per cent. Industrial expansion clearly came to a complete halt under the influence of extraordinary cyclical forces.

But the next biennial period—that from 1921 to 1923—exhibited just as strikingly the force of the underlying tendencies toward expansion. The increase in output from 1921 to 1923, as registered by the production index, was nearly 54 per cent. Much of this increase represented nothing more than the return to normal activity after the terrific slump of 1920–21; the record of 1921 to 1923, like that of 1919 to 1921, is predominantly a record of cyclical change. But the recovery in 1923 from the depression of 1921 carried output to levels not previously attained. The industrial expansion characteristic of the earlier years was again in evidence.

The strength of this underlying tendency toward expansion is best observed for the years since 1919 if the collapse of 1921 is removed from the record and 1923 is compared directly with 1919. Industrial output, as measured by the production index, showed an increase of 22 per cent in 1923 over 1919. The normal rate of industrial expansion characteristic of the pre-war periods thus appears to have been still effective in the years from 1919 to 1923.

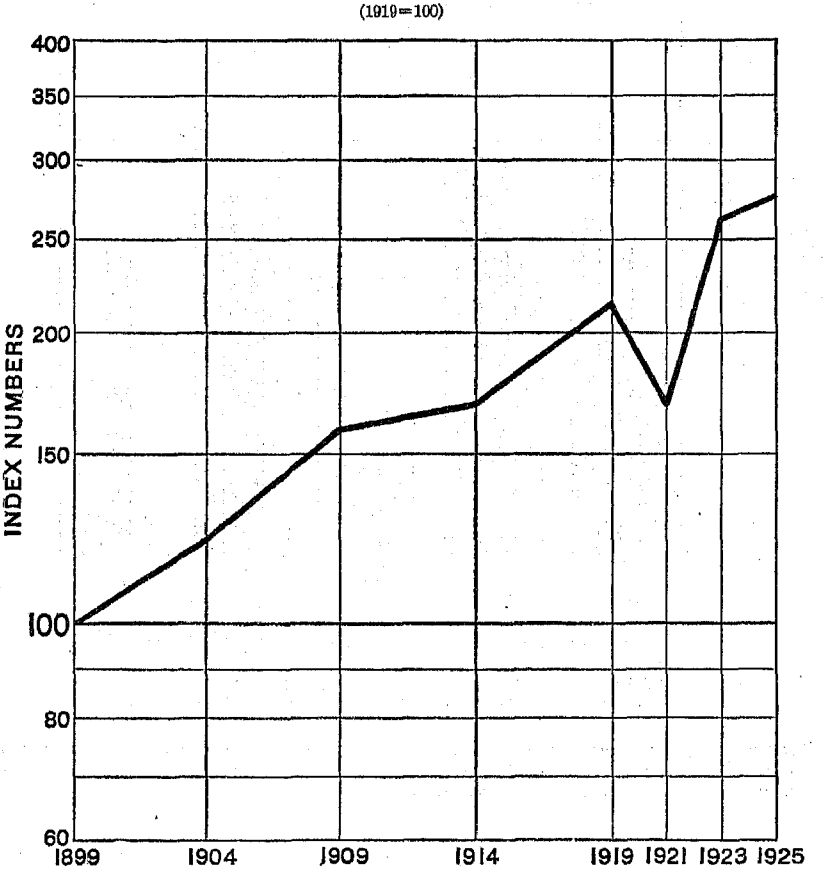
Long-time tendencies toward expansion may be brought out even more clearly if the records of all the censuses from 1899 to 1923 are brought together and considered as a whole. The data may be reduced to simplest form if the output of 1899 is made a base of reference equal to 100 per cent, and the output of all later census years expressed as a percentage of the output of this base year. Again measurement may be best effected through the production index. Results given by the index are shown in Table 1 and on Chart I.

TABLE 1.—VOLUME OF MANUFACTURE IN THE UNITED STATES: 1899 TO 1923

CENSUS YEAR	Production index (1899=100)	CENSUS YEAR	Production index (1899=100)
1899	100	1919	214
1904	122	1921	170
1909	150	1923	261
1914	169		

The most striking feature of this record of the 24-year period as a whole is the persistent upward movement. Business depression, war restriction, and monetary deflation have held the underlying tendencies at times in check. But as soon as these temporary restraints have been removed, marked expansion has again occurred. For the 24-year period as a whole, the rate of expansion has been

CHART I.—VOLUME OF MANUFACTURE IN THE UNITED STATES: 1899 TO 1925



almost exactly 4 per cent per annum. When it is recalled that the rate of increase of population in the United States during this same period was only about 1.7 per cent per annum, the record of industrial expansion becomes truly impressive.

The conclusions as to the general growth of manufacture have been based up to this point on the index of physical production. For all industries combined, this index appears to be reasonably dependable and conclusive. But, as previously indicated, attention may be profitably given, nevertheless, to certain indirect evidences—

to the average number of wage earners employed and to the total horsepower of prime movers installed in manufacturing establishments. To what extent does the record afforded by these indirect lines of evidence accord with that given by the production index?

The data are set forth in full in Table 2, and in part on Chart II.

CHART II.—GROWTH OF MANUFACTURE IN THE UNITED STATES, BY CENSUS PERIODS: 1899 TO 1923

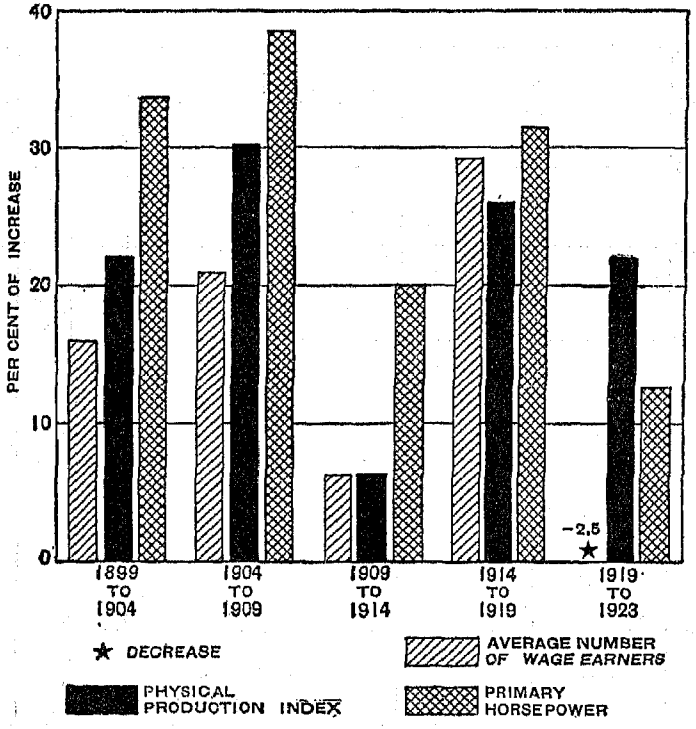


TABLE 2.—PER CENT OF INCREASE IN PHYSICAL PRODUCTION, AVERAGE NUMBER OF WAGE EARNERS EMPLOYED, AND PRIMARY HORSEPOWER INSTALLED, FOR CENSUS PERIODS: 1899 TO 1923

INTERCENSAL PERIOD	PER CENT OF INCREASE OF DECREASE (—) IN—			
	Physical production index (A)	Average number of wage earners (B)	Primary horsepower (C)	Weighted average of (B) and (C)[1]
1899–1923	160.7	88.2	229.6	116.5
1899–1919	113.7	93.0	192.2	114.1
1919–1923	22.0	—2.5	12.8	1.1
1921–1923	53.7	26.4	----------	----------
1919–1921	—20.6	—22.8	----------	----------
1914–1919	26.1	29.3	31.5	29.8
1909–1914	6.4	6.4	20.1	9.7
1904–1909	30.2	21.0	38.5	25.1
1899–1904	22.2	16.0	33.6	20.2

[1] Geometric average with weight of (B)=3, and weight of (C)=1.

The details of this table suggest two important conclusions. In the first place it is clear that during the period from 1899 to 1919 the differences exhibited between the results from the direct and the indirect evidences are so slight as to be readily accounted for in the cyclical conditions prevailing in the various census years. Upon the whole, direct and indirect evidences for the 20-year period are in substantial agreement. In the second place, it is obvious that the situation since 1919 has been radically different. Restrictive immigration laws have created a new employment situation. Increases of output since 1919 have been secured without those increases of the working force which were typical of the pre-war years. Clearly, output per worker must have risen markedly. The matter is of fundamental significance and invites further and more intensive analysis. There are no grounds for believing, however, that the record of the production index since 1919 should be seriously questioned. For all industries combined, the index is a dependable register even for the postwar period. Industrial expansion at a rapid rate is a fundamental feature of the full 24-year period from 1899 to 1923.

But it is not to be supposed that this expansion has occurred in all lines. Some industries have grown much more rapidly than others; some have actually declined. It is important to supplement the record for all industries combined, by an account of the differences which appear in the records of particular divisions and trades. Analysis along this line is undertaken in the chapters that follow.

IV

DIFFERENTIATION OF MANUFACTURING INDUSTRIES

The analysis made in the preceding chapter dealt altogether with manufacturing as a whole. No attempt was made to distinguish industries, nor even broad groups of industries. Presumably behind the general results thus obtained are differences of wide-ranging character. While some industries, long established and fully stabilized, follow closely the course of manufacturing as a whole, other industries are in process of rapid development to normal stature, and still others are in various states of decadence under the influence of fundamental changes in industrial organization or in consumers' demand. It is desirable that the more important differences of this sort be examined.

Analysis along this line requires classification of manufacturing industries—a clear recognition of the various distinct lines of manufacture. The extent to which differentiation had best be carried involves a number of considerations. Conceivably every important product might be separately examined. But any such procedure is precluded by at least two considerations: (1) The great complexity which this would give to the study—for, obviously, the variety of products turned out by modern industry is almost limitless; (2) the impossibility of distinguishing certain products in the customary census returns. The returns from a single manufacturing establishment have ordinarily to be assigned to a single industry. This has a definite bearing upon what shall be considered a single industry. If several different products are commonly made by the same establishment, it is impracticable to think of these several products as involving more than one industry. The Bureau of the Census strives constantly to maintain distinctions between one well-defined and commonly recognized industry and another.[1]

Upon the whole, the bureau has succeeded in determining and in following highly significant industrial classifications. Grouping of industries into general classes was first made in the census of 1899, and the classification adopted at that time was kept practically uniform in all censuses until 1923. In the census of 1923, however, the grouping was somewhat revised in order to reduce in size the

[1] If a single plant runs into more than one industry, it is ordinarily classified according to its product of chief value. This has the effect of swelling unduly the returns for some industries and contracting unduly the returns for others. While these inaccuracies in reporting do not seriously impair the value of census data as a whole, they should be clearly recognized in any analysis of details for individual industries.

miscellaneous group and to give recognition to important changes which have occurred in our industrial structure since the beginning of the century. In this monograph, however, the old grouping has been retained for the following reasons: (1) Data for censuses prior to that of 1914 have not been regrouped in accordance with the new scheme, and therefore it can not be followed in making comparisons with earlier periods; (2) the chief merit of the new grouping is a recognition of changes which have been taking place slowly and therefore, although it is more useful than the former classification for recent and possible future comparisons, it is not necessarily so for a study stretching back into an earlier period of somewhat different industrial arrangements; (3) since this study was originally made to end with the 1919 census and all tables were arranged in accordance with the previous classification, the change to the new forms, even though possible for all years, would involve a vast amount of detailed work without appreciably improving the nature of the presentation. Classification and grouping according to the scheme observed by the Bureau of the Census merit careful examination. Their general character is evident from the major headings and subheadings. These are as follows:

Former Classification	*1923 Classification*
FOOD AND KINDRED PRODUCTS:	FOOD AND KINDRED PRODUCTS:
Animal products.	Animal products.
Vegetable products.	Vegetable and mineral products.
TEXTILES AND THEIR PRODUCTS:	TEXTILES AND THEIR PRODUCTS:
Textile fabrics and materials.	Textile-mill products.
Articles from textile fabrics for personal wear.	Wearing apparel made from purchased fabrics.
Other textile fabrics.	Other articles made from purchased fabrics.
IRON AND STEEL AND THEIR PRODUCTS:	IRON AND STEEL AND THEIR PRODUCTS:
Crude iron and steel and rolled products.	Crude iron and steel and rolled products.
Other iron and steel products.	Other iron and steel products.
LUMBER AND ITS REMANUFACTURES.	LUMBER AND ALLIED PRODUCTS.
LEATHER AND ITS FINISHED PRODUCTS.	LEATHER AND ITS MANUFACTURES.
	RUBBER PRODUCTS.
PAPER AND PRINTING:	PAPER AND PRINTING:
Paper and wood pulp.	Paper and wood pulp.
Manufactures of paper.	Manufactures of paper.
Printing and publishing.	Printing and publishing and allied industries.
Industries relating to printing and publishing.	Other allied industries relating to printing and publishing.
Wall paper, not made in paper mills.	
LIQUORS AND BEVERAGES.	
CHEMICALS AND ALLIED PRODUCTS.	CHEMICALS AND ALLIED PRODUCTS.

Former Classification—Continued	*1923 Classification*—Continued
STONE, CLAY, AND GLASS PRODUCTS: Industries using stone as material. Industries using clay as material. Glass and manufactures of glass.	STONE, CLAY, AND GLASS PRODUCTS: Industries using stone as material. Industries using clay as material. Glass and manufactures of glass.
METALS AND METAL PRODUCTS, OTHER THAN IRON AND STEEL: Metals. Metal products. Related industries.	METALS AND METAL PRODUCTS, OTHER THAN IRON AND STEEL: Metals. Smelting and refining. Metal products. Electroplating.
TOBACCO MANUFACTURES.	TOBACCO MANUFACTURES.
	MACHINERY (NOT INCLUDING TRANSPORTATION EQUIPMENT).
	MUSICAL INSTRUMENTS AND PHONOGRAPHS.
VEHICLES FOR LAND TRANSPORTATION.	TRANSPORTATION EQUIPMENT, AIR, LAND, AND WATER.
RAILROAD REPAIR SHOPS.	RAILROAD REPAIR SHOPS.
MISCELLANEOUS INDUSTRIES.	MISCELLANEOUS INDUSTRIES.

Examination of the designations in this classification discloses at once the dual nature of the basis upon which the classification rests. Predominantly the classification has regard for the materials from which the industries in question fashion their products. Textile fabrics, hides and leather, wood pulp and paper, iron and steel, stone, clay, and glass, rubber, and lumber—these are important basic materials for subsequent manufacture. But this is not the sole basis of classification. The character of the use to which the product is put is a second. Thus we have the food group, the liquor and beverage group, the vehicle group, the subgroup (under the textile heading) of "articles from textile fabrics for personal wear," and in the new classification the machinery and musical instruments groups. Neither the basis of "character of basic materials" nor that of "character of use of product" is used to the exclusion of the other. Furthermore, neither seems to govern; the two are employed in combination, now one being dominant, now the other. Apparently that basis has been adopted in each line of manufacture which has led to the simpler classification. As a whole, nevertheless, the classification may be said to be based on "nature of basic material," supplemented by "nature of use of product."

The more detailed analysis in the present study will observe the census classification of industries. It will do this, however, with a modification of the order in which the groups are ordinarily presented in census publications. Apparently the groups were originally arranged for publication by the bureau in order of importance, as

indicated by value of products, and for convenience this order has been maintained by the bureau despite its loss of significance. A regrouping would seem to make the classification somewhat more significant. Consequently, for the purposes of this monograph, the following arrangement will be adopted:

Iron and steel and their products.
Nonferrous metals and their products.
Chemicals and allied products.
Stone, clay, and glass products.
Lumber and its remanufactures.
Paper and printing.
Textiles and their products.
Leather and its finished products.
Food and kindred products.
Liquors and beverages.
Tobacco manufactures.
Vehicles for land transportation, including railroad repair shops
Miscellaneous products.

This arrangement clearly recognizes in a general way the use to which the products of the several different groups are to be put. For the most part, the products of the three groups standing at the top of the revised classification find their way into further industrial processes and into industrial apparatus and equipment. The next two groups (stone, clay, and glass products, and lumber and its remanufactures) provide materials which are consumed largely in new construction. The paper and printing group stands more or less by itself—a group whose products in some measure go almost immediately to the consumer but are to a considerable extent employed in the merchandising and shipping of other goods. The textiles and leather groups are concerned almost altogether with the production of clothing and footwear for immediate consumption. The food, drink, and tobacco groups manifestly minister directly to the consumer. The group producing vehicles for land transportation combines two rather different lines, namely, automobile manufacture and the manufacture of railway equipment. In both these lines, however, the product is finished goods for one specific use. Subsequent use of product clearly is made more evident by the amended arrangement.

While this arrangement of the groups is designed to bring out important differences in the use of the various manufactured products, and for this reason is upon the whole the most satisfactory form of the census classification, still another arrangement is to be recognized. The various materials which are fashioned in manufacture for final use are drawn from fundamentally different sources. Agriculture, including animal husbandry, forestry, and mining are generally recognized as the major sources of raw material.[2] From this point of

[2] This basis of differentiation is emphasized by Walter W. Stewart in the construction of his index of production. See American Economic Review, Vol. XI, p. 59, March, 1921.

view the textiles, leather, food, drink, and tobacco groups fall in one division; the lumber and paper groups fairly clearly in the second; and the metals, chemicals, and stone, clay, and glass groups in a third. It is clear that the groups of the census classification do not consistently recognize this fundamental distinction regarding the sources of raw material, but the differences may, nevertheless, be followed roughly in the different industrial groups. They suggest another significant approach to the census data.

The relative importance of the different industrial groups in the census classification may well be considered before their respective rates of expansion are analyzed. Two bases of judgment suggest themselves: (1) Average number of wage earners; (2) value added by manufacture. The percentage which each industrial group constitutes of the total for all lines of manufacture on these bases of measurement is given in Table 3. It will be observed that the relative importance of the several groups is substantially different in the two sections of the table.

TABLE 3.—RELATIVE IMPORTANCE OF INDUSTRIAL GROUPS.

GROUP	PER CENT OF TOTAL						
	1923	1921	1919	1914	1909	1904	1899
AS INDICATED BY AVERAGE NUMBER OF WAGE EARNERS							
All industries	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Iron and steel and their products	17.4	14.8	17.4	15.1	15.5	15.9	15.8
Metals and metal products, other than iron and steel	3.7	3.4	3.7	3.7	3.8	3.6	3.4
Chemicals and allied products	4.6	4.7	4.7	4.3	4.0	4.2	4.2
Stone, clay, and glass products	3.9	3.6	3.3	4.8	5.2	5.2	4.9
Lumber and its remanufactures	10.2	9.7	9.2	11.8	13.8	13.4	14.3
Paper and printing	6.0	6.7	5.6	6.4	6.3	6.4	6.3
Textiles and their products	19.6	21.7	17.7	21.4	21.9	21.3	21.8
Leather and its finished products	3.9	4.0	3.8	4.4	4.7	4.8	5.3
Food and kindred products	7.1	8.2	7.5	7.1	6.2	6.5	6.4
Liquors and beverages	.4	.5	.6	1.3	1.2	1.2	1.2
Tobacco manufactures	1.7	2.2	1.7	2.5	2.5	2.9	2.8
Vehicles for land transportation	5.8	4.1	5.5	3.7	3.1	2.5	2.8
Railroad repair shops	6.0	6.0	5.7	5.2	4.6	4.5	3.8
Miscellaneous industries	9.7	10.3	13.5	8.3	7.3	7.5	6.9
AS INDICATED BY VALUE ADDED BY MANUFACTURE							
All industries	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Iron and steel and their products	18.0	14.1	18.3	14.8	16.0	16.0	17.0
Metals and metal products, other than iron and steel	3.7	3.2	3.4	4.0	4.1	4.2	4.5
Chemicals and allied products	7.7	8.0	7.4	7.2	7.0	7.0	6.4
Stone, clay, and glass products	3.8	3.3	2.7	3.8	4.1	4.3	3.9
Lumber and its remanufactures	7.5	6.8	6.8	8.5	10.2	11.2	10.9
Paper and printing	8.6	9.9	6.8	8.9	8.5	8.8	8.1
Textiles and their products	15.7	17.2	15.3	14.5	15.5	14.4	15.3
Leather and its finished products	3.1	3.3	3.6	3.6	3.8	3.9	3.8
Food and kindred products	8.8	10.4	9.3	10.0	8.8	8.6	8.6
Liquors and beverages	.6	.7	1.5	5.3	5.7	5.7	6.0
Tobacco manufactures	2.0	2.4	2.1	2.9	2.8	3.3	3.5
Vehicles for land transportation	6.6	5.1	6.2	4.5	3.0	2.3	2.6
Railroad repair shops	3.4	4.2	3.2	2.9	2.6	2.7	2.4
Miscellaneous industries	10.3	11.3	13.2	9.1	7.9	7.8	7.0

From the point of view of the present study, value added in manufacture seems a more significant index of relative importance than number of wage earners employed. On this basis the most important industrial group is that devoted to the manufacture of iron and steel and their products. The manufacture of textiles and their products, however, is very nearly as important. Food and kindred products, paper and printing, chemicals and allied products, and lumber and its remanufactures are next in order. The groups of the least importance are stone, clay, and glass products, leather and its products, nonferrous metals and their products, and tobacco.[3] Perhaps the most striking feature of the data is the stability of the percentage figures; except for an increase in the importance of the vehicle group (owing to the growth of the automobile industry) and a decline in the liquors and beverages group, the relative importance of the different industrial groups shows no radical change over a period of 24 years.

[3] According to the 1923 classification, whereby certain industries producing machinery have been removed from the iron and steel group, the order is changed somewhat, with textiles leading, machinery generally second, and iron and steel and food and kindred products of approximately equal importance.

V

THE GROWTH OF MANUFACTURE, BY INDUSTRIAL GROUPS

The classification of industries developed in the preceding chapter may be made the basis of a more detailed examination of the growth of manufacture during the census years 1899 to 1923. The rate of growth disclosed by the analysis of all industries combined is a composite of widely varying changes. Some groups of industries have exhibited a much more rapid expansion than others. It is desirable to consider these differences in order that any persistent relationships may be discovered.

In comparing the growth of manufacture for the different industrial groups, the index numbers of physical volume of production, described in a previous chapter, will provide the principal evidence where available, but changes shown in the average number of wage earners and in primary horsepower are also to be considered. For some industrial groups these latter two lines of evidence will be the only bases of comparison. Growth of manufactures by groups of industries as indicated by these three schemes of measurement is given for each intercensal period and for the entire period from 1899 to 1923 in Table 4. The group index numbers are further shown on Chart III. Indexes are given separately on the charts for the shipbuilding and rubber industries, which in the case of wage earners and horsepower are included in the miscellaneous group. The index computed for liquors and beverages is composed only of data for alcoholic drinks, and consequently is not representative of all industries in the group, which includes also the manufacture of soft drinks for which no quantitative data are available. Since the trend of production of alcoholic beverages has been opposite to that for nonalcoholic beverages in recent years, no figures for any part of this group were included in the index for years subsequent to 1919. Wage earners and horsepower for railroad repair shops have been combined with those for vehicles, whereas the vehicles index includes for repair shops only a limited amount of data. In other cases important industries are frequently missing from the group indexes, but they sufficiently cover the basic products to warrant their acceptance as fairly representative.

CHART III.—GROWTH OF MANUFACTURE, BY INDUSTRIAL GROUPS: 1899 TO 1925
(1919=100)

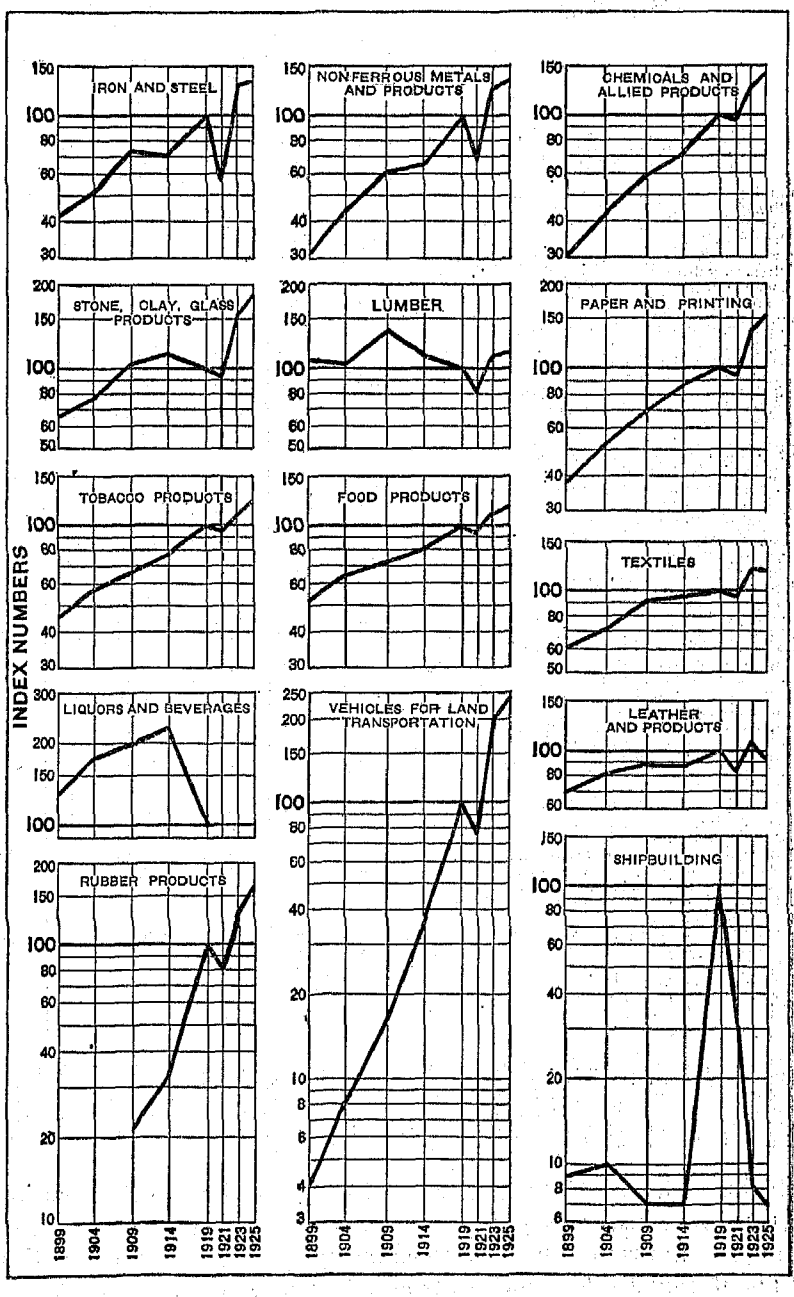


TABLE 4.—GROWTH OF MANUFACTURE, BY INDUSTRIAL GROUPS: 1899 TO 1923[1]

INDUSTRIAL GROUP	PER CENT OF INCREASE OR DECREASE (−)					
	24-year period, 1899–1923	Intercensal period				
		1919–1923	1914–1919	1909–1914	1904–1909	1899–1904
All groups:						
Physical volume of production	160.7	22.0	26.1	6.4	30.3	22.2
Average number of wage earners	88.2	−2.5	29.3	6.4	21.0	16.0
Primary horsepower	229.6	12.8	31.5	20.1	38.5	33.6
Iron and steel and their products (III):						
Physical volume of production	209.7	31.2	40.6	−5.6	45.4	19.9
Average number of wage earners	105.1	−3.6	49.4	3.4	18.2	16.6
Primary horsepower	308.8	10.7	46.0	21.4	37.1	52.0
Nonferrous metals and their products (X):						
Physical volume of production	300.3	25.7	54.1	7.1	36.2	41.7
Average number of wage earners	103.5	−3.2	29.5	5.0	25.7	23.0
Primary horsepower	467.5	23.2	71.9	24.2	59.2	35.5
Chemicals and allied products (VIII):						
Physical volume of production	314.2	25.1	41.4	20.2	37.1	42.1
Average number of wage earners	106.4	−5.0	42.5	12.1	17.6	15.7
Primary horsepower	487.6	32.5	39.2	43.1	40.6	58.3
Stone, clay, and glass products (IX):						
Physical volume of production	131.2	55.6	−11.9	8.8	32.2	17.2
Average number of wage earners	50.3	16.6	−10.7	−2.4	20.1	23.1
Primary horsepower	274.3	21.6	5.3	20.2	60.0	52.1
Lumber and its remanufactures (IV):[1]						
Physical volume of production	3.5	10.1	−9.6	−19.4	32.0	−2.3
Average number of wage earners	35.5	8.5	.7	−8.6	24.2	9.3
Primary horsepower	58.1	−2.2	7.3	−2.0	46.5	4.9
Paper and printing (VI):[1]						
Physical volume of production	274.6	37.1	14.3	25.4	34.5	41.8
Average number of wage earners	79.1	4.9	12.6	8.9	18.3	17.7
Primary horsepower	200.7	16.9	14.5	22.6	28.0	43.2
Textiles and their products (II):						
Physical volume of production	102.5	22.9	3.3	5.3	27.8	18.5
Average number of wage earners	67.1	6.7	6.9	4.3	24.3	13.1
Primary horsepower	173.0	16.4	19.0	20.3	31.1	25.0
Leather and its finished products (V):						
Physical volume of production	51.3	5.6	14.4	−.3	7.6	16.8
Average number of wage earners	38.8	−1.2	13.8	−.9	17.1	6.4
Primary horsepower	163.0	8.0	22.4	13.1	38.1	27.4
Food and kindred products (I):[1]						
Physical volume of production	110.6	11.6	23.8	8.0	14.9	22.8
Average number of wage earners	108.2	−8.2	38.0	20.6	16.2	17.3
Primary horsepower	123.9	3.0	28.9	15.6	22.8	18.8
Liquors and beverages (VII):						
Physical volume of production	----	----	−56.9	18.3	15.3	32.5
Average number of wage earners	−42.2	−42.5	−37.1	13.3	13.9	24.0
Primary horsepower	−2.3	−40.1	−21.0	17.8	28.4	36.6
Tobacco manufactures (XI):						
Physical volume of production	137.1	9.8	30.9	14.7	15.2	24.8
Average number of wage earners	11.9	−5.6	−12.2	7.2	4.6	20.3
Primary horsepower	95.2	.3	24.2	22.5	15.9	10.4
Vehicles for land transportation and railroad repair shops (XII, XIII):						
Physical volume of production	4,434.0	99.5	177.8	130.8	90.0	86.4
Average number of wage earners	248.3	8.2	60.8	24.0	31.9	22.4
Primary horsepower	759.2	40.4	63.7	42.3	81.8	44.6
Miscellaneous products (XIV):						
Average number of wage earners	154.5	−30.4	109.5	21.5	18.0	25.2
Primary horsepower	636.5	10.3	80.6	51.9	39.7	74.3

[1] These figures are given for the purpose of showing growth of manufactures as a whole and by groups, as indicated by different means of measurement. The three sets of data for individual groups should not be used as an indication of changes in output per worker, because in some cases the group index is based upon data for industries which are not entirely representative of the group as a whole, whereas the figures for wage earners and horsepower are totals for the entire group. This is particularly true of the lumber group and to a less degree of food products and paper and printing.

During the period from 1899 to 1904, according to these various lines of evidence, the greatest expansion appears to have been among the industries in the miscellaneous group, with the growth in output of vehicles for land transportation also large. Other leaders

were chemicals, stone, clay, and glass products, liquors and beverages, and metals. The group lowest in the list was lumber, in which the volume of output showed practically no increase. Leather and textiles showed relatively small increases. Food products and tobacco were close to the average for all industries.

The relationships disclosed in the growth of manufacture for the quinquennial period 1904–1909 are somewhat different. Expansion in the output of vehicles for land transportation was much more rapid during this period than the increase of manufacture in any other line. The metals group, and the two groups having to do primarily with building materials (stone, clay, and glass products, and lumber and its remanufactures) also showed substantial increases. The chemicals, textiles, and paper and printing groups expanded in line with the growth of industry as a whole. In the food, drink, and tobacco groups the rates of increase fell substantially below the rates shown for all manufacture. In general, the period from 1904 to 1909 appears to have been unusual in the uniformity of expansion in almost all divisions of manufacture.

Records for the period 1909–1914 are dominated, it will be recalled, by the fact that 1914 was a year of industrial depression. The general increase, as shown by the production index and by wage earners, was only 6 per cent, whereas horsepower at the end of the period was only 20 per cent larger than in 1909. The percentages of increase covering this period, shown in Table 4, were smaller for most of the items shown than in any census period from 1899 to 1919. It is interesting to note that under these conditions the food, drink, and tobacco groups show practically the highest average increase of any of the combinations of groups recognized in the analysis. Among the individual groups, vehicles for land transportation and miscellaneous products show by far the greatest expansion of output during this period. Chemicals, liquors and beverages, tobacco, food products, and paper and printing follow at some distance behind the leaders. Textiles and nonferrous metals showed a slight increase, but decreases were noted in at least one of the three items considered in the iron and steel, stone, clay, and glass, and leather groups, and in the case of lumber, production, employment, and horsepower were all reduced. From this comparison it would appear, as might be expected, that lines of manufacture connected with industrial materials and equipment are much more definitely affected by industrial conditions than those having to do with the current necessaries of life, such as food in its various forms. It is interesting to note, however, that the manufacture of clothing and footwear seems to have been as much depressed during this period as the manufacture of such important industrial materials as iron and steel and the nonferrous metals.

For the period 1914–1919 the most striking feature of the record is the irregularity of the changes from group to group. The miscellaneous group shows by far the greatest increase. The explanation of this is to be found in the extraordinary development of two or three lines of industry, of which shipbuilding is by far the most important. Vehicles for land transportation show the next largest increase, an increase, which, of course, merely reflects the extraordinarily rapid development of automobile manufacture. The metals and chemicals groups stand together with rates of increase running well above the average for all groups combined. Food and kindred products show a high rate of growth, as did the output of tobacco products, although wage earners in the latter industry decreased. Liquors and beverages, under the influence of war prohibition, showed drastic reductions. Textiles, leather, and paper and printing exhibited considerable expansion, yet no such increase as those displayed by other lines of manufacture. The groups concerned with building materials bring up the bottom of the list, showing actual decreases in output for this quinquennial period, a result which is readily accounted for by the restrictions on building operations which prevailed during the war period.

After 1919 records are available biennially, but all movements within that period were so dominated by fluctuations incident to the depression of 1921 and recovery in the following two years that evidence of growth is provided only by direct comparison of 1923 with 1919. The four-year period, furthermore, corresponds more closely in duration with the quinquennial periods used in previous comparisons. Another disadvantage of the use of 1921 data is that horsepower statistics were not compiled in that year, and therefore the picture is not only incomplete but is limited to those features that are affected greatly by so-called cyclical fluctuations, which in that year were most extreme.

Data for 1921 in comparison with 1919 and 1923, nevertheless, are significant because of the light that they throw on the character of movements in a period of decline from great activity to depression and of subsequent recovery to prosperity. An analysis of the available evidence indicates that those industries which had previously shown the greatest growth, as a rule, declined the furthest from 1919 to 1921. These were notably the metals industries and vehicles. The industries supplying more staple articles of consumption goods, on the other hand, which had not expanded so rapidly—textiles, food products, and tobacco—declined the least. Leather, paper and printing, the building materials, and chemicals were close to the average. The greatest recession of all was, of course, shipbuilding, in which a program of great war-time expansion was being curtailed. Liquors and beverages also declined further following adoption of national

prohibition. In the succeeding biennial period 1921–1923 the rates of recovery among the various industries, as a rule, corresponded with the degrees of decline from 1919 to 1921. Vehicles and metals led the list, with building materials next in order, reflecting the great increase in building activity which characterized that period. Rates of increase in the cases of tobacco, food products, and textiles were close to the bottom. Shipbuilding and liquors and beverages, of course, continued to decline.

The net resultant for the entire period 1919–1923 was substantial growth for industry as a whole, characterized by almost amazing increases in automobiles and related industries—rubber tires and petroleum refining—by the largest output of building materials since before the war, and by moderate increases in the production of iron and steel, nonferrous metals, textiles, and paper. With the exception of shipbuilding and liquors and beverages, which decreased under the influence of special circumstances, leather, food products, and tobacco showed the smallest increases for the period.

When the growth of manufactures by industrial groups for the 24-year period from 1899 to 1923, taken as a whole, is considered, it is evident that the expansion of industries manufacturing vehicles for land transportation stands at the top of the list, with the miscellaneous group second, and chemicals and metals next. The increase for paper and printing follows in order. Tobacco (as measured by increases in physical output, although not in wage earners or horsepower), food products, and stone, clay, and glass products are close to the center of the list. Textiles and leather stand fairly close together, well below the average for all industries. Growth of the lumber industry has been very small, and liquors and beverages have shown net decreases since the beginning of the century.

Viewing these figures as a whole, a number of conclusions may be drawn regarding relative rates of growth in different lines of manufacture since 1899. The phenomenal increase in the output of automobiles is a fact too commonly recognized to call for further comment. The high increase in the output of miscellaneous products reflects in part the exceptionally rapid expansion of production of such articles as phonographs, photographic equipment and supplies, rubber products, and electrical appliances and machinery. The fact that the metals and chemicals groups stand well above the average for all groups combined bespeaks the increasing industrialization of modern economic life. Products most closely related to the consumer—food and tobacco on the one hand and clothing and footwear on the other—show increases which vary widely but in general are clearly well above the rate of increase of population, which for this 24-year period was nearly 50 per cent. In the light

of the figures, it may safely be concluded that manufacturing output is more than keeping pace with the expansion of population. Though the figures throw no light on the way in which the greater output of manufacturing enterprise has been distributed among the population, there is convincing proof that the real income of the community, as measured in finished manufacturing products, increased appreciably during the quarter of a century recently ended. Full understanding of the extent of this increase requires, however, an examination of certain particulars which appear only in the details of the record to which thus far no attention has been given.

VI

CONTRASTS IN THE FOOD, DRINK, AND TOBACCO GROUPS

In the food, drink, and tobacco groups we encounter trades that are vitally related to the ultimate consumer. In the previous chapter it was shown that the growth of consumers' goods during the past 24 years has been rather less rapid than industrial expansion in other directions. While this is a valid generalization, it overlooks many of the differences which are to be observed among the different individual trades. Manufacture of certain products in the food, drink, and tobacco groups has apparently increased very rapidly during the past quarter of a century.

Conclusions concerning *relative* increases of output in the various food, drink, and tobacco trades are to be drawn from the records of the average number of wage earners employed, and of horsepower of prime movers, supplemented as may be by actual production data. Changes, as indicated by index numbers of the physical volume of production in certain of these industries, are shown in Table 5 and on Chart IV. Table 5 also shows data on wage earners and horsepower for a more inclusive list of trades.

From inspection of the table it is evident that the manufacture of foodstuffs and tobacco during the 24 years 1899–1923 far outstripped the production of drink.[1] This is largely the result of prohibition, which led in 1919 and later years to a marked decline in both the average number of wage earners and primary horsepower reported for the liquors and beverages group. The growth of manufacture in the liquors and beverages group, for the intercensal periods from 1899 to 1914, was at approximately the same rate as in the food group. The tobacco industry since 1899 has been characterized by a change in its principal product from cigars to cigarettes, which has involved little change in total number of wage earners employed. Machinery has been introduced rapidly, but the growth in horsepower has not been as great as that which has taken place in the output of cigarettes.

[1] No account is taken here of the volume of illicit production of intoxicants.

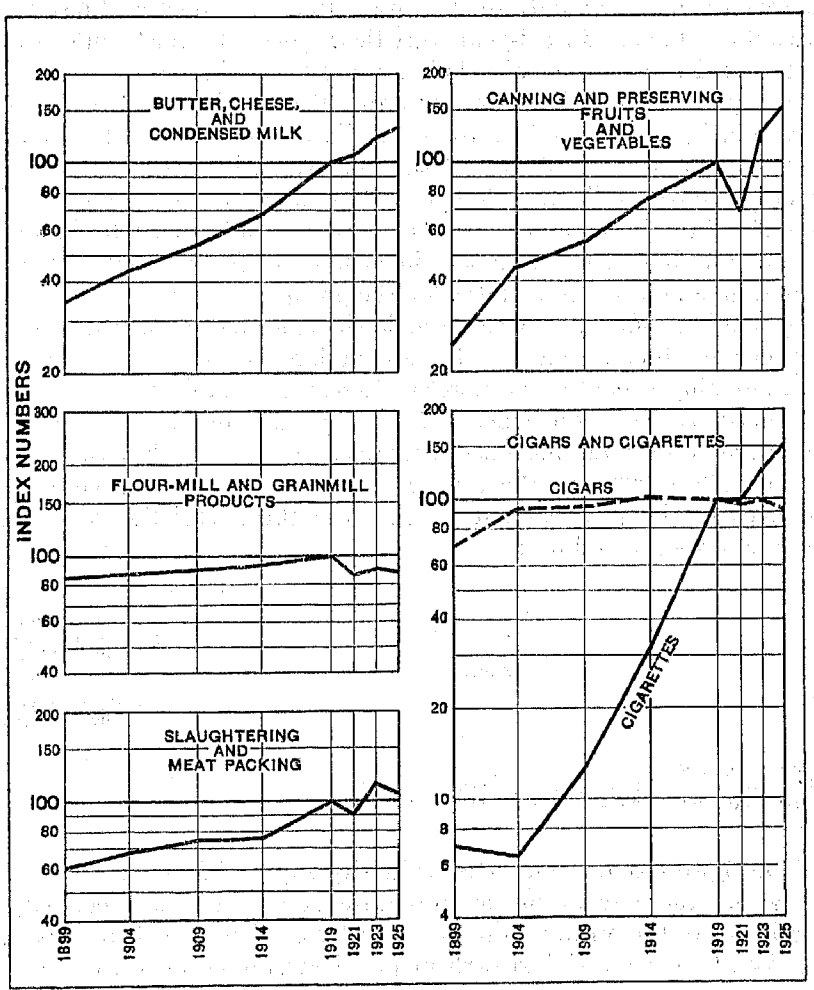
TABLE 5.—FOOD, DRINK, AND TOBACCO INDUSTRIES—PER CENT OF INCREASE, FOR CENSUS PERIODS: 1899 TO 1923

INDUSTRY	PER CENT OF INCREASE OR DECREASE (−)					
	24-year period, 1899–1923	Intercensal period				
		1919–1923	1914–1919	1909–1914	1904–1909	1899–1904
INCREASE IN PHYSICAL VOLUME OF PRODUCTION						
Food and kindred products	110.6	11.6	23.8	8.0	14.9	22.8
Butter, cheese, and condensed milk	260.0	22.4	47.5	29.0	19.5	29.4
Slaughtering and meat packing	86.5	13.0	32.1	1.2	10.2	12.0
Flour-mill and grain-mill products	8.3	−8.9	4.8	4.6	4.2	4.0
Canning and preserving, fruits and vegetables	415.0	26.7	29.4	41.8	20.6	83.7
Liquors and beverages	(1)	(1)	−56.9	18.3	15.3	32.5
Tobacco	137.1	9.8	30.9	14.7	15.2	24.8
INCREASE IN AVERAGE NUMBER OF WAGE EARNERS						
Food and kindred products	108.2	−8.2	38.0	20.6	16.2	17.3
Animal products	90.5	−15.5	57.6	15.5	18.5	4.5
Vegetable products	116.8	−4.7	30.4	22.6	15.4	23.3
Liquors and beverages	−42.2	−42.5	−37.1	13.3	13.9	24.0
Tobacco products	11.9	−5.6	−12.2	7.2	4.6	20.3
Food products, animal:						
Butter, cheese, and condensed milk	164.8	−3.8	52.8	25.5	18.0	21.9
Slaughtering and meat packing	94.2	−17.5	62.9	12.5	13.5	8.4
Food products, vegetable:						
Chocolate and cocoa products	423.2	−24.3	118.3	47.2	35.2	59.1
Sugar, beet	284.5	−35.7	47.3	11.0	81.8	101.2
Confectionery and ice cream (including chewing gum)	232.2	−9.7	54.4	43.5	23.2	34.9
Food preparations, not elsewhere specified	220.9	−13.2	49.5	35.7	32.1	38.0
Bread and other bakery products	172.4	15.8	14.1	23.8	23.3	35.0
Pickles, preserves, and sauces	113.4	−7.2	32.0	31.8	12.2	17.8
Canning and preserving, fruits and vegetables	56.7	−4.3	20.9	24.3	1.3	7.5
Flour-mill and grain-mill products	9.6	−22.3	14.5	.7	.9	21.4
Liquors and beverages:						
Mineral and soda waters	117.0	9.3	12.5	17.9	20.8	23.8
Liquors, malt, including cereal beverages	−71.6	−67.3	−44.8	13.7	13.4	22.0
Tobacco products:						
Tobacco, cigars and cigarettes	27.7	−4.9	−9.2	9.5	8.1	31.0
Tobacco, chewing and smoking, and snuff	−44.0	−10.9	−29.5	−4.6	13.5	−17.7
INCREASE IN HORSEPOWER OF PRIME MOVERS						
Food and kindred products	123.9	3.0	28.9	15.6	22.8	18.8
Animal products	240.5	7.3	40.9	27.6	44.8	21.9
Vegetable products	102.7	1.8	25.8	12.8	18.6	18.3
Liquors and beverages	−2.3	−40.1	−21.0	17.8	28.4	36.6
Tobacco products	95.2	.3	24.2	22.5	15.9	10.4
Food products, animal:						
Butter, cheese, and condensed milk	123.7	16.6	29.0	29.1	8.0	6.6
Slaughtering and meat packing	350.5	6.6	41.9	25.0	74.6	36.4
Food products, vegetable:						
Chocolate and cocoa products	1,613.3	41.2	69.4	86.3	103.0	89.3
Sugar, beet	783.6	.3	66.1	34.1	61.2	145.4
Confectionery and ice cream (including chewing gum)	1,282.3	44.2	83.5	182.8	47.7	25.2
Food preparations, not elsewhere specified	1,054.5	19.0	87.7	45.1	95.9	81.9
Bread and other bakery products	761.1	16.6	54.0	65.0	75.3	65.7
Pickles, preserves, and sauces	461.5	64.0	19.4	46.8	25.6	55.6
Canning and preserving, fruits and vegetables	417.3	5.1	50.0	47.3	34.7	65.4
Flour-mill and grain-mill products	6.0	−18.9	6.6	−3.7	10.1	15.6
Liquors and beverages:						
Mineral and soda waters	717.9	57.4	66.0	29.8	58.8	52.0
Liquors, malt, including cereal beverages	−20.3	−51.4	−20.1	16.7	30.6	34.5
Tobacco products:						
Tobacco, cigars and cigarettes	445.6	1.6	79.3	47.5	52.6	33.0
Tobacco, chewing and smoking, and snuff	5.0	−1.4	−11.2	10.5	3.9	4.5

[1] Index not computed after 1919.

Within the liquors and beverages group, a marked difference is to be noted. The production of soft drinks has increased more rapidly than that of malt liquors, quite apart from the effects of prohibition during the past few years. Comparison of the increases for the

CHART IV.—GROWTH OF MANUFACTURE OF FOOD AND TOBACCO PRODUCTS: 1899 TO 1925
(1919=100)



three 5-year intercensal periods from 1899 to 1914 shows that for both average number of wage earners and primary horsepower, the increases were greater in the case of soft drinks than in the case of malt liquors. Of course, the actual decline in the production of malt liquors for the periods 1914–1919 and 1919–1923 accentuate the difference between these two lines of manufacture. The effect

of prohibition has been, in fact, to increase the demand for other than alcoholic beverages, and between 1919 and 1923, the number of wage earners employed in the mineral and soda water industry increased by 9 per cent, while decreases were noted in most other industries of this group. Furthermore, the amount of horsepower in that industry during the same period increased by nearly 60 per cent. Increases as great as that occurred in few industries. Satisfactory quantitative data of the production of liquors and beverages are not available. Fiscal-year statistics reported by the Commissioner of Internal Revenue for distilled and fermented liquors were included in the production index from 1899 to 1919, but in recent years they have not been used for two reasons. In the first place, the industry has become too small to be significant, and, secondly, evidence quoted above indicates that the downward trend noted in this branch of the industry has been at least partially offset by increases in mineral beverages, and the inclusion of one without the other would give an erroneous index for the group.

A striking contrast is observable in the manufacture of the different tobacco products. The production of large cigars and of chewing and smoking tobacco has increased only moderately since 1899 and has actually decreased since 1914. The manufacture of cigarettes, upon the other hand, has risen by leaps and bounds. For the 24-year period 1899–1923 and the 9-year period 1914–1923, the percentage changes in the physical output of these three varieties of tobacco products were as follows:

PRODUCT	PER CENT OF INCREASE OR DECREASE (—)	
	1899 to 1923	1914 to 1923
Tobacco and snuff	40	—7
Cigars (weighing more than 3 pounds per 1,000)	41	—3
Cigarettes (weighing not more than 3 pounds per 1,000)	1,710	302

The figures reflect an extraordinarily rapid change in the use of tobacco. Increase in the manufacture of tobacco has been largely confined to the production of cigarettes. The effect has been a steady and substantial growth in physical volume of output for the industry and a moderate increase in horsepower with only a slight expansion in number of wage earners, as the manufacture of cigarettes is much more largely a machine process than is that of cigars.

Among foodstuffs, the most notable increases are to be found in the manufacture of certain vegetable products which can hardly be viewed as among the necessaries of life. By far the largest increase for the 24-year period 1899–1923 is shown in the manufacture of

chocolate and cocoa products. It is significant that two out of the remaining three products that head the list are beet sugar, and confectionery and ice cream. The American people have developed an extraordinary appetite for sweets, and this naturally finds expression in the statistics of manufacturing output.

The other group of products standing among the first four is "Food preparations, not elsewhere specified." The most important single trade under this heading is that engaged in the manufacture of "breadstuff preparations such as cereals and table foods." In general, this industry as a whole includes various food products of a more highly manufactured sort. The rapid growth in this line of business undoubtedly reflects an increase in consumption of prepared foods of every description. The widely advertised breakfast food is simply illustrative of a tendency for manufacture to intervene in the preparation of foodstuffs for the modern table. This same tendency is evidenced by the rapid growth of the manufacture of "Bread and other bakery products." Here, as in other lines, the factory with its modern equipment and scores of operatives is displacing in part the work of the housewife. It should be clearly recognized that the growth of manufacture when it involves this sort of substitution does not add directly to the material income of consumers. Manufacture expands, but the products from which we draw our subsistence exist in no greater volume.

The validity of this line of reasoning is confirmed by the figures for flour-mill and gristmill products. From this industry, after all, are obtained the basic materials for the manufacture of bread and other bakery products. The increase of flour and grain milling from 1899 to 1923 was relatively slight, both as represented by average number of wage earners and by primary horsepower. The figures of wheat-flour production available for all the census years substantiate the story. Production of wheat flour in barrels for 1923 was only about 15 per cent greater than the production in 1899 and was slightly less than in 1914. Presumably the quantity of breadstuffs actually consumed has not increased in much larger proportion.

Clearly, in the manufacture of vegetable foodstuffs, we are confronted by the combined effects of two different lines of development: First, the manufacture of less staple foods to meet newly developed or rapidly growing tastes—such as the Nation has acquired for chocolate, confectionery, ice cream, and chewing gum; and second, the production within the factory of more staple articles formerly prepared largely by the housewife. It is probable that actual output of the more staple articles has not increased during the past quarter of a century much more rapidly than the population; that is, not much more than 50 per cent. But the production of foodstuffs within factories has undoubtedly increased at a much higher rate.

The same ideas apply to the manufacture of animal food products. In the case of slaughtering and meat packing, the data on the dressed weight of animals slaughtered would indicate an increase of about 74 per cent from 1899 to 1923. On the other hand, both average number of wage earners and primary horsepower suggest a much higher rate of growth. What has happened undoubtedly has been a larger and larger derivation of product from the animals slaughtered, a higher and higher degree of fabrication in the meat-packing industry. By-products are now utilized that formerly went to waste. Various specialized foodstuffs are produced and inspected and packed with increasing care. Part of all this represents an actual increase of manufacture in excess of the increase of materials consumed in manufacture; part, upon the other hand, represents improvement of quality which can hardly be included specifically in one's concept of manufacturing growth. No clearer example exists of the complications—discussed in Chapter I—involved in the concept of a general growth of manufacture.

The rapid growth of manufacture of butter, cheese, and condensed milk is primarily an illustration of the invasion by manufacture of fields formerly assigned to other lines of business enterprise. Butter, cheese, and milk formerly were regarded as farm products, and in large part were such. They are increasingly becoming factory products. The rapid growth of the manufacture of these products, evidenced in the average number of wage earners, in primary horsepower, and in physical quantity produced, shows this transition. The figures probably must be discounted if one is to obtain an accurate notion of the increase in the volume of these products available for consumption.

The increase in the output of canned and preserved fruits and vegetables is not adequately indicated by statistics of wage earners. Physical production in number of cases of goods canned during 1923 was about four times as great as in 1899. Apparently this growth was largely effected by additions to power as the amount of primary horsepower in the industry increased during the period by approximately the same amount as production. This, however, is another illustration of growth in manufacturing which does not represent equally as great an increase in consumption, as undoubtedly factory canned and preserved products are displacing those formerly put up in the home. On the other hand, it is undoubtedly true that the consumption of canned goods of all kinds has increased considerably in the past quarter century.

The index of the physical volume of production for food products probably understates growth of manufacture in this group. The industries in which increases of wage earners and horsepower have been greatest are of such a nature that statistics of physical output are not collected, and therefore most of them are not represented in

the index. A relatively unimportant exception is beet sugar. For the most important industry of the group—slaughtering and meat packing—it was pointed out that the number of pounds of meat produced was probably not an accurate indicator of changes in the increasingly varied volume of manufacture in that industry. The indexes for canning and preserving and for butter, cheese, and condensed milk probably give a fairly accurate picture of what has occurred in the manufacture of these products.

VII

CONTRASTS IN THE TEXTILE AND LEATHER GROUPS AND AMONG OTHER CONSUMPTION GOODS

"Textiles and their products" and "Leather and its finished products" are two groups falling naturally together, because they are primarily concerned with the production of clothing and footwear for direct consumption. The textile group in the census classification is divided into two parts: (*a*) Textile fabrics and materials, and (*b*) articles from textile fabrics for personal wear.[1] Though the recent extraordinary expansion of automobile-tire manufacture has created a substantial demand for textile fabrics outside the range of wearing apparel, the great bulk of textile fabrics still find their way into clothing of one form or another. Thus the group of "Textiles and their products" has to do primarily with wearing apparel. The group of "Leather and its finished products" is similarly divided in the census classification into (*a*) leather, tanned, curried, and finished, and (*b*) finished products of leather. In this case, as in that of textiles, fabrication runs largely in one direction. The finished products of leather consist very largely of footwear. In the two groups of textile and leather products, then, we deal with lines of manufacture which closely resemble one another in that they yield products destined for immediate use by the ultimate consumer.

TABLE 6.—TEXTILE AND LEATHER INDUSTRIES—PER CENT OF INCREASE, FOR CENSUS PERIODS: 1899 TO 1923

INDUSTRY	PER CENT OF INCREASE OR DECREASE (—)					
	24-year period, 1899–1923	Intercensal period				
		1919–1923	1914–1919	1909–1914	1904–1909	1899–1904
INCREASE IN PHYSICAL VOLUME OF PRODUCTION						
Textiles and their products	102.5	22.9	3.3	5.3	27.8	18.5
Cotton goods	83.6	22.8	—1.6	8.3	25.4	11.8
Knit goods	160.0	15.2	7.6	7.0	41.1	38.8
Silk goods	259.7	16.9	36.6	23.1	41.3	29.5
Woolen and worsted goods	81.1	28.2	—4.1	—.9	21.2	22.6
Leather and its finished products	51.3	5.6	14.4	—.3	7.6	16.8
Leather, tanned, curried, and finished	30.4	4.7	16.3	—4.2	.2	11.6
Boots and shoes, leather	60.8	6.0	13.1	2.7	9.8	19.0

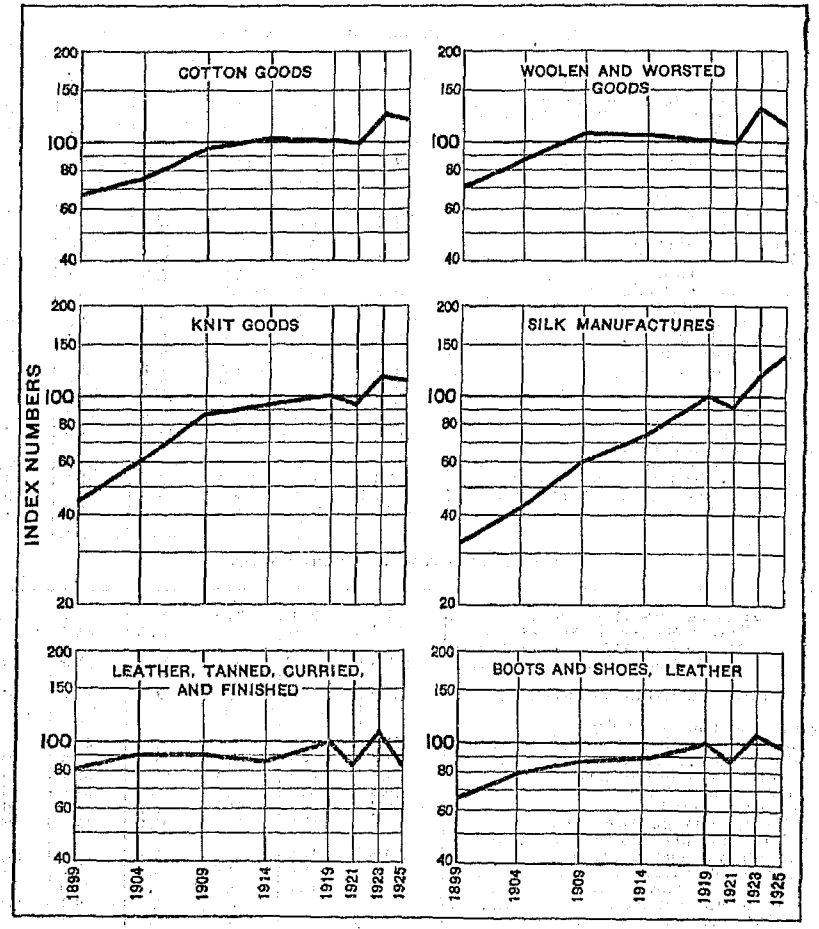
[1] A third subdivision, "other articles from textile fabrics," is of negligible significance and in the present study has been included in the group of textile fabrics and materials.

TABLE 6.—TEXTILE AND LEATHER INDUSTRIES—PER CENT OF INCREASE, FOR CENSUS PERIODS: 1899 TO 1923—Continued

INDUSTRY	PER CENT OF INCREASE OR DECREASE (−)					
	24-year period, 1899-1923	Intercensal period				
		1919-1923	1914-1919	1909-1914	1904-1909	1899-1904
INCREASE IN AVERAGE NUMBER OF WAGE EARNERS						
Textiles and textile products	67.1	6.7	6.9	4.3	24.3	13.1
Textile fabrics and materials	70.4	10.7	10.7	4.5	18.9	11.8
Articles from textile fabrics for personal wear	56.7	−1.2	−.6	.5	36.1	17.2
Leather and leather products	38.8	−1.2	13.8	−.9	17.1	6.4
Textile fabrics and materials:						
Knit goods (including hosiery)	132.2	12.6	14.7	10.4	24.2	24.4
Silk goods	91.5	−1.2	17.2	9.2	24.4	21.7
Cotton goods (including lace)	60.7	9.5	13.1	4.2	10.6	4.2
Woolen and worsted goods	54.6	16.7	5.1	−2.8	14.9	12.8
Cordage and twine	25.0	−7.0	11.8	7.8	.1	11.4
Carpets and rugs, other than rag	24.0	53.6	−26.8	−6.0	.3	16.9
Articles from textile fabrics for personal wear:						
Millinery and lace goods	224.6	7.7	12.3	15.5	42.5	63.0
Men's clothing	61.7	11.6	.9	−9.1	39.4	13.4
Women's clothing	59.6	−19.3	−1.9	9.9	32.9	38.2
Men's furnishing goods	211.8	.0	24.4	41.1	−2.9	24.4
Shirts	42.4	31.7	−23.8	7.1	32.9	−.3
Corsets	31.2	−12.4	−10.2	16.7	60.0	−10.8
Hats, fur-felt	−11.4	−9.6	−13.2	−14.9	13.7	16.8
Men's collars and cuffs	−39.0	−5.8	9.9	−18.7	15.2	−37.1
Leather and leather goods:						
Trunks and valises	65.2	.3	15.7	−10.9	22.3	30.5
Boots and shoes (including cut stock)	58.8	6.7	10.2	3.5	23.5	5.7
Leather, tanned, curried, and finished	14.6	−17.6	29.6	−10.1	8.7	9.8
Saddlery and harness	−52.1	−34.0	−19.7	−11.4	−2.7	4.7
INCREASE IN HORSEPOWER OF PRIME MOVERS						
Textiles and textile products	173.0	16.4	19.0	20.3	31.1	25.0
Textile fabrics and materials	171.3	17.6	19.4	19.5	30.2	24.2
Articles from textile fabrics for personal wear	211.5	.3	10.5	32.5	53.6	38.0
Leather and leather products	163.0	8.0	22.4	13.1	38.1	27.4
Textile fabrics and materials:						
Knit goods (including hosiery)	224.9	22.9	20.5	21.3	31.7	37.4
Silk goods	265.4	18.6	51.2	19.4	36.5	25.0
Cotton goods (including lace)	174.4	17.2	17.4	22.5	31.4	24.0
Woolen and worsted goods	130.5	15.5	22.9	9.5	25.6	18.2
Cordage and twine	115.2	8.7	20.3	17.2	15.2	21.9
Carpets and rugs, other than rag	104.5	43.3	−13.2	14.0	13.6	26.9
Articles from textile fabrics for personal wear:						
Millinery and lace goods	750.6	26.2	−2.0	60.8	67.2	155.8
Men's clothing	298.2	31.0	13.8	18.6	42.5	58.1
Women's clothing	180.0	−14.5	14.9	27.4	49.5	49.7
Men's furnishing goods	589.8	−4.5	53.6	47.6	30.1	144.9
Shirts	98.4	−5.6	−15.2	39.2	45.1	22.7
Corsets	66.8	−15.2	1.4	54.0	39.5	−9.7
Hats, fur-felt	56.2	−9.3	−2.2	8.3	15.7	40.4
Men's collars and cuffs	119.7	−4.3	35.7	20.5	37.0	2.5
Leather and leather goods:						
Trunks and valises	119.6	−5.5	1.8	9.9	37.3	51.4
Boots and shoes (including cut stock)	170.6	10.9	20.4	16.7	52.8	13.7
Leather, tanned, curried, and finished	159.6	5.7	26.4	16.6	26.1	32.2
Saddlery and harness	29.1	−5.4	−21.0	−39.7	133.8	22.5

For the more important textile and leather trades percentage changes in physical volume of production, as indicated by index numbers, are given in Table 6 and on Chart V, and Table 6 also shows increases in the average number of wage earners and in primary

CHART V.—GROWTH OF MANUFACTURE OF TEXTILE AND LEATHER PRODUCTS: 1899 TO 1925
(1919=100)



horsepower. Attention may be focussed largely on increases for the full 24-year period from 1899 to 1923.

The details for the several textile-fabric trades may first be examined. A number of contrasts are to be noted. The greatest increase from 1899 to 1923 in the average number of wage earners is found in the production of knit goods, including hosiery, with the manufacture of silk goods a close second. As measured by increases in both quantity of goods produced and horsepower of prime movers, on the other

hand, the silk industry is in first place and knit goods second. The increase in the knit-goods industry has been to a large extent in hosiery and in outer wear, including sweaters, jerseys, scarfs, etc., rather than in underwear. In the underwear industry, important developments, especially in recent years, have been the growing use of silk underwear by women and of so-called athletic underwear by men, and the increasing popularity in knit underwear of union suits in place of two-piece garments, all of which have tended to reduce somewhat the importance of the knit-underwear industry. The increase in hosiery and silk manufacture has been somewhat related, the production of silk hosiery increased from 12,600 dozen pairs in 1899 to 4,640,000 dozen pairs in 1923, and output of silk-mixed hosiery has also increased rapidly. Rayon, now a textile fiber of some importance, has come so recently into prominence that its production was not reported separately until 1923, and it was not designated as a separate industry by the Bureau of the Census until 1925, and at that time was continued as a part of the chemical group.

Cotton goods, woolen and worsted goods, and cordage and twine show much smaller increases than silk and knit goods. Carpets and rugs, other than rag, which actually decreased from 1899 to 1919, increased in production, wage earners, and horsepower by approximately 50 per cent in the four years from 1919 to 1923, and thereby showed a net increase for the 24-year period. This recent growth reflects the influence of the large number of new homes built and furnished in 1922 and 1923. Oilcloth, linoleum, and asphalted-felt-base floor coverings have had even greater increases.

The results confirm one's general impressions. The rapid increase in the use of silk and recently of rayon in personal apparel is one of the outstanding features of changing fashion in dress during the past few years. Cotton and wool have to do with more conservative and thoroughly established lines of use. In these more thoroughly stabilized trades the increase in the average number of wage earners has not been markedly different from the rate of increase of the population. Industrial expansion in the manufacture of silk, on the other hand, has apparently been much greater than the growth of population during the same period.

Among articles from textile fabrics for personal wear, the largest percentage increases for the period 1899–1923, as judged by average number of wage earners and by horsepower, were in millinery and lace and men's and women's clothing. The manufacture of corsets has not grown as rapidly and in the past decade has declined considerably. Men's furnishings and other articles of men's attire show only moderate increases in wage earners. In some cases actual decreases were registered for the period 1899–1923. Considerable

increases in primary horsepower were reported, however, for some of the trades. Presumably, there has been increasing resort to machinery in the manufacture of men's wearing apparel. Unfortunately, there are no actual production records with which to ascertain the precise facts in this important line of production.

As already stated, the finished products of leather consist largely of boots and shoes, such other products as saddlery and harness and trunks and valises being now of negligible importance. This line of manufacture seems to illustrate the definite tendency toward increasing fabrication of product. The increase in boot and shoe production from 1899 to 1923 was approximately 61 per cent. The record of an increase of 59 per cent in wage earners and of 171 per cent in horsepower would suggest a somewhat greater enlargement of output. The explanation of the failure of physical volume to expand with wage earners and primary horsepower may lie either in increasing fabrication of the product or in restriction on output. The case is an excellent illustration of the difficulties of interpreting satisfactorily data regarding the growth of manufacture. In the tanning of leather, on the other hand, production has increased to a greater extent than the number of wage earners, apparently by means of the wider application of machinery.

In general, the manufacture of clothing and footwear shows a decided increase for the period 1899–1923. This increase, on the whole, is somewhat above the increase shown by population, but by no means as greatly above as in several other lines of manufacture. The highest increases in the trades making articles for personal wear apparently run largely to luxuries rather than necessaries. All through these groups of consumers' goods there is evidence of increasing fabrication—increasing resort to factory processes. It is probable that this accounts for the greater increase of manufacture along these lines than population. It is doubtful whether there was any material advance during the years 1899–1923 in the per capita volume of staple goods available for final consumption.

Among certain varieties of consumption goods quite a different situation prevails, for some articles of consumption are still in process of introduction. In Table 7, percentage increases in the average number of wage earners are shown for industries dealing with four different products, all of which are employed in amusement or entertainment of one kind or another.

TABLE 7.—INDUSTRIES PRODUCING MISCELLANEOUS CONSUMPTION GOODS—PER CENT OF INCREASE, FOR CENSUS PERIODS: 1899 TO 1923

INDUSTRY	PER CENT OF INCREASE OR DECREASE (−)					
	24-year period, 1899–1923	Intercensal period				
		1919–1923	1914–1919	1909–1914	1904–1909	1899–1904
INCREASE IN AVERAGE NUMBER OF WAGE EARNERS						
Phonographs and graphophones	1,518.6	−28.6	206.2	80.4	63.0	168.1
Photographic materials	373.9	−4.6	97.3	67.0	36.3	10.7
Toys and games	340.3	2.8	80.1	48.7	22.5	30.6
Musical instruments and materials	4.2	−3.3	−3.9	6.4	21.4	−1.4
INCREASE IN HORSEPOWER OF PRIME MOVERS						
Phonographs and graphophones	3,705.2	2.5	243.7	83.5	152.6	133.1
Photographic materials	1,373.6	74.7	74.6	90.8	70.7	48.3
Toys and games	411.6	11.7	112.8	27.5	11.9	50.8
Musical instruments and materials	29.4	−6.4	10.6	11.8	33.1	−16.0

The contrasts shown are illuminating. In the case of musical instruments and materials until 1914, we find an increase not unlike that displayed by other lines of consumers' goods, but in the past decade there has been little or no growth in production, wage earners, or horsepower in this industry. The increases shown in the other three cases, however, are very different. The average number of wage earners employed rose for toys and games, 340 per cent; for photographic materials, 374 per cent; and for phonographs and graphophones, 1,519 per cent. The latter two instruments of entertainment and amusement—as well as education—have enjoyed during recent years a phenomenal popularity. The decline in the phonograph and graphophone industry from 1919 to 1923, however, should be noted. From 1914 to 1919, the number of wage earners employed and the amount of horsepower of prime movers in the industry tripled and the actual production of instruments quadrupled, but in the following four years production was cut in half and employment declined by nearly 30 per cent.[2] Either the so-called "saturation point" for this industry has been reached or the competition offered by the new radio industry has been of effective importance. Despite this decrease, the growth of manufacture since 1899 in the case of phonographs and graphophones has been more rapid than in any other industry except the automobile industry.

Radio apparatus is produced by establishments classified under "Electrical machinery, apparatus, and supplies" industry. Statis-

[2] For production figures see Table 37, Appendix B.

tics of physical quantity of such products manufactured were not collected in detail until 1923. Dollar figures, which are not strictly comparable for every year, indicate a rapid growth from 1914 to 1925, most of which came between 1921 and 1925. The value of radio apparatus produced in 1925 was $170,390,572; 1923, $54,000,470; 1921, $10,646,817; 1919, $8,074,636; and 1914, $792.465.

It is an interesting commentary on current tendencies that among consumption goods, the lines of manufacture which have shown the most rapid rates of growth have been lines concerned with the production of goods primarily devoted to recreation and diversions of one kind or another.

VIII

CONTRASTS IN OTHER GROUPS

It is neither necessary nor desirable to consider changes in each of the many individual industries covered by the census returns.[1] But it is worth while to examine certain further contrasts disclosed by the census records, contrasts which are suggestive of fundamental changes taking place in the development of manufacture in this country. It is proposed, therefore, to single out the data for selected industries and comment in turn upon the significance of the differences thus disclosed.

In the iron and steel group, for example, marked divergences are evident in the rates of increase in the manufacture of different iron and steel products. The increase in the average number of wage earners for this group as a whole in the period 1899–1923 was 105 per cent. In the manufacture of iron and steel and rolled products [2] the average number of wage earners increased 115 per cent during the same 24-year period. In the same time the tonnage production of rolling-mill products has tripled and the amount of horsepower for the group has quadrupled. Interesting changes in capacity and efficiency within these industries producing rolling-mill products during the past decade are apparent from the following percentages of change:

	1914–1923	1919–1923	1914–1919
	Per cent	*Per cent*	*Per cent*
Tonnage production	86	31	42
Wage earners	50	4	45
Primary horsepower	55	10	41

Between 1914 and 1919, the period of war expansion, an increase in production of over 40 per cent was accompanied by corresponding increases in number of wage earners and in power. From 1919 to 1923, however, with little change in number of wage earners and only a 10 per cent increase in power, tonnage output was enlarged by over 30 per cent. This is a good example of what has apparently taken place in many other industries, i. e., by means of greater utilization of labor-saving machinery and devices, the more efficient use of power,

[1] If any one of these is of particular interest, consult the details given in Tables 32 to 43, pp. 147 to 200.

[2] Including iron and steel products, not made in steel works or rolling mills, although largely made in such, as well as wire and wirework, not elsewhere specified.

and other economies of operation, production has been expanded without a corresponding increase in the number of wage earners employed or in the installed horsepower of prime movers.

The various highly fashioned products of iron and steel show widely varying increases for the 24-year period. Data are given in Table 8 for some of these and for certain machinery industries, two of which—electrical machinery and agricultural implements—are not classified by the census in the iron and steel group. Those industries primarily concerned with the manufacture of machinery (and in 1923 placed by the Census Bureau in the new machinery group) have been segregated in the tables from the other iron and steel industries.

TABLE 8.—IRON AND STEEL PRODUCTS AND MACHINERY—PER CENT OF INCREASE, FOR CENSUS PERIODS: 1899 TO 1923

INDUSTRY	PER CENT OF INCREASE OR DECREASE (−)					
	24-year period, 1899–1923	Intercensal period				
		1919–1923	1914–1919	1909–1914	1904–1909	1899–1904
INCREASE IN AVERAGE NUMBER OF WAGE EARNERS						
All iron and steel products	105.1	−3.6	49.4	3.4	18.2	16.6
Iron and steel:						
Steam fittings and heating apparatus	377.0	20.3	39.0	12.9	100.0	26.4
Plumbers' supplies, not elsewhere classified	239.1	100.2	−26.4	−4.0	79.1	34.0
Crude iron and steel products plus [1]	115.2	3.6	44.5	2.8	23.1	13.6
Hardware	88.7	17.5	3.1	7.0	21.4	19.8
Cutlery and edge tools	38.8	−15.9	19.9	−2.6	16.9	20.9
Machinery:						
Cash registers and calculating machines	624.4	−9.5	84.7	20.0	83.0	97.3
Electrical machinery, apparatus, and supplies [2]	459.1	10.6	79.9	35.3	44.3	43.9
Typewriters and supplies	245.1	−4.4	41.3	15.8	53.7	43.6
Foundry and machine shops, including certain machinery industries [3]	99.8	−6.8	58.0	2.4	15.1	15.1
Sewing machines and attachments	.5	−30.1	6.8	−6.5	12.5	28.1
Agricultural implements [2]	−33.5	−43.0	12.2	−4.1	6.7	1.7
INCREASE IN PRIMARY HORSEPOWER						
All iron and steel products	308.8	10.7	46.0	21.4	37.1	52.0
Iron and steel:						
Steam fittings and heating apparatus	1299.8	35.0	74.7	17.0	208.6	64.3
Plumbers' supplies, not elsewhere classified	693.7	102.0	5.3	8.3	107.0	66.4
Crude iron and steel products plus [1]	293.6	10.4	40.6	20.3	37.4	53.4
Hardware	249.5	17.2	26.5	27.7	25.1	47.4
Cutlery and edge tools	64.9	12.0	12.0	7.9	−.6	22.5
Machinery:						
Cash registers and calculating machines	2130.3	104.0	38.0	52.9	67.8	208.9
Electrical machinery, apparatus, and supplies [2]	1001.3	9.6	92.7	43.4	50.7	141.3
Typewriters and supplies	404.4	−12.3	20.0	59.1	53.6	96.1
Foundry and machine shops, including certain machinery industries [3]	387.1	18.7	57.9	18.9	52.2	43.6
Sewing machines and attachments	123.7	−29.7	32.2	24.7	13.2	70.4
Agricultural implements [2]	72.6	−4.9	5.6	20.7	12.1	27.0

[1] See footnote 2, p. 65. [2] Not included in the group total given above. [3] See footnote 3, p. 67.

The rapid growth in the manufacture of cash registers and calculating machines and of typewriters and supplies is significant of the increasing use of machinery in offices. The increases from 1919 to 1923 in the number of wage earners engaged in the manufacture of plumbers' supplies, steam heating apparatus, hardware, tools, and electrical machinery, apparatus, and supplies reflect the great construction activity of 1923 and adjoining years. The industry designated as "Foundries and machine shops" is a sort of a catch-all for establishments which manufacture machinery and parts but which, because they make such a wide variety of products or for other reasons, can not be elsewhere classified.[3] From time to time establishments have been taken from this combination to form new industries. Some of these are those producing locomotives, stoves, engines, machine tools, and textile machinery. The figures given in the accompanying table include these industries, which all together in 1923 employed about 70 per cent of the total number of wage earners in the machinery group of industries, according to the new census classification, and over 40 per cent of those in the iron and steel group, according to the classification followed in this monograph.[4] These industries showed a large increase from 1914 to 1919, but the growth for the entire period has been slightly below the average for all industries.

A contrast of interest is that between electric machinery and agricultural machinery and implements. Percentage increases in the average number of wage earners and in primary horsepower for these two industries also appear in Table 8. In the case of the manufacture of agricultural implements there has actually been a net decrease in wage earners since 1899. Undoubtedly this is in part due to technical improvements in this line of manufacture leading to somewhat greater use of machinery; but that this is not the principal explanation is indicated by the fact that the increase of primary horsepower during the 24-year period from 1899 to 1923 was only 73 per cent. Production of agricultural implements does not seem to have expanded greatly from 1899 to 1919, and from 1919 to 1923, a period of agricultural depression, the output of agricultural implements decreased by an average of about 25 per cent. The growth of manufacture of electric apparatus and supplies, upon the other hand, has been very rapid indeed. Furthermore, it has been persistent throughout each of the five-intercensal periods. Index numbers of production were computed for recent years from statistics of selected products for these two industries, and, although they were not considered suitable for inclusion in the general index, their results are of

[3] See footnote 8, for Tables 29, 30, and 31, Appendix B, p. 146, for industries used in computing percentages given in the above table. For a complete list of products made in these industries see Abstract of Census of Manufactures, 1914, pp. 115-119.

[4] See Ch. IV, p. 39.

some significance. They are given in Table 24, page 110, Appendix A.[5] The decrease in output of units of agricultural machinery and increase in electrical machinery is rather strikingly demonstrated by these figures, which, however, it should be remembered, are subject to a large margin of error owing to the difficulty of obtaining strictly comparable units. This contrast between electrical and agricultural apparatus, shown by several lines of evidence, although not surprising, is certainly a striking example of the trend of modern mechanical arts.

It is obvious from the above data that widely different rates of increase are to be observed in any stated period in lines of manufacture utilizing the same basic material. Some trades are enjoying the advantage of rapid introduction of their product; others have to do with products which are already well established and thoroughly stabilized. Still others are affected by the declining use of their products. In the figures for broad industrial groups, such as iron and steel and their products, or textiles and their products, these differences are entirely concealed.

In the group of lumber and its remanufactures we find a situation quite different from that in iron and steel. Some of the more instructive figures are given in Table 9.

TABLE 9.—LUMBER AND ITS REMANUFACTURES—PER CENT OF INCREASE, FOR CENSUS PERIODS: 1899 TO 1923

INDUSTRY	PER CENT OF INCREASE OR DECREASE (−)					
	24-year period, 1899–1923	Intercensal period				
		1919–1923	1914–1919	1909–1914	1904–1909	1899–1904
INCREASE IN PHYSICAL VOLUME OF PRODUCTION						
Lumber	3.5	10.1	−9.6	−19.4	32.0	−2.3
INCREASE IN AVERAGE NUMBER OF WAGE EARNERS						
Lumber and its remanufactures	35.5	8.5	0.7	−8.6	24.2	9.3
Furniture	90.4	20.1	8.2	3.6	12.1	26.2
Boxes, wooden packing, except cigar boxes	78.4	−7.5	10.1	8.7	16.9	37.9
Coffins, burial cases, etc	69.6	−2.4	25.6	1.4	10.3	23.8
Lumber and timber products	23.0	5.7	.2	−12.3	35.3	−2.1
Lumber and planing-mill products	46.2	20.5	−10.3	−11.6	15.1	32.9
INCREASE IN HORSEPOWER OF PRIME MOVERS						
Lumber and its remanufactures	58.1	−2.2	7.3	−2.0	46.5	4.9
Furniture	319.8	83.1	9.2	13.8	29.2	42.8
Boxes, wooden packing, except cigar boxes	174.0	4.1	13.6	12.7	30.9	57.1
Coffins, burial cases, etc	208.4	23.2	17.6	16.3	25.1	47.6
Lumber and timber products	40.6	−18.0	7.6	−5.4	55.4	8.4
Lumber and planing-mill products	121.5	18.6	1.0	2.9	32.6	35.5

[5] For production of individual products of these industries, 1914 to 1923, see Table 37, Appendix B.

As is generally known, sources of the raw material for the lumber trades are being steadily depleted and the substitution of other materials for lumber is taking place rapidly. The growth of manufacture of the grosser products of this group—such products, for example, as timber and the simpler planing-mill products—was relatively slight during the 20-year period from 1899 to 1919. For that period the increase in the average number of wage earners in the two industries making these products was only 17 per cent. Since 1919, however, as a result of large building activity, the demand for lumber has been greater, and production has increased. This has been effected with a relatively small addition to the number of employees and with an actual decrease in horsepower at sawmills. The increase in wage earners in the case of furniture for the 24-year period was 90 per cent, and in the case of wooden packing boxes was 78 per cent, as compared with only 23 per cent for lumber and timber products. Apparently among the more highly fabricated products, limitation of the raw material does not prevent fairly rapid expansion of output. Other influences dominate growth. In the case of furniture—obviously for the most part consumers' goods—we find the percentage increase until 1919 not unlike that displayed by other consumers' goods, such as clothing and footwear; since 1919, however, the tremendous volume of new homes built has called for an increase in the production of furniture greater than in previous years. The manufacture of packing boxes until 1919 appeared to be influenced by the growth of trade and transportation and increased more rapidly than furniture, but in recent years the growing tendency to substitute paper-board boxes for those made of wood is reflected in the comparison of the census statistics for these two industries.[6]

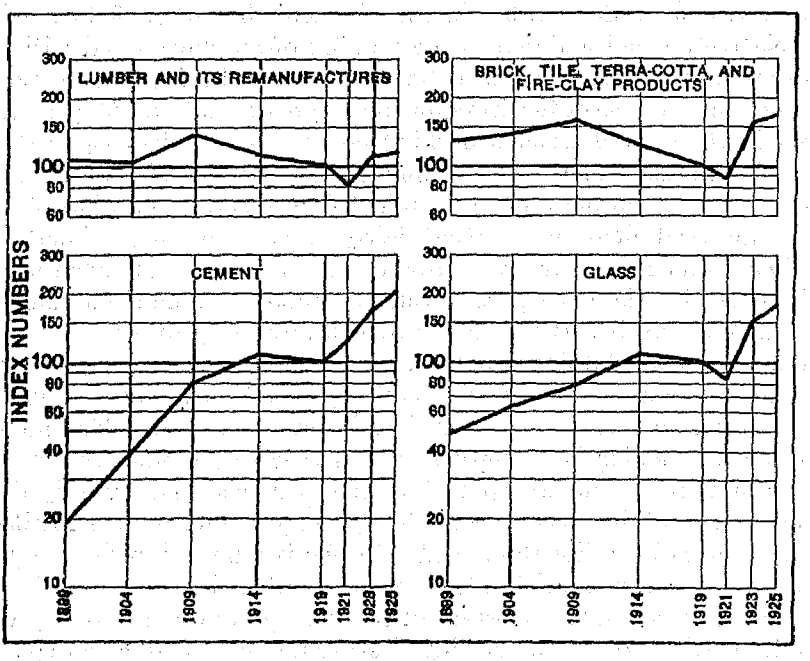
The only available statistics of physical production in this group of industries are those showing the production of different species of lumber, which have been used to make the production index shown in Table 9. These contain figures for custom mills and for small establishments in some years and omit them in others and therefore are not strictly comparable, but they do indicate increasing output of lumber until about 1909, a decrease in the following decade, and an increase in recent years, with the maximum, attained in 1923, still below output for most years from 1909 to 1916.

Other evidence of fluctuations in construction activity may be seen in the stone, clay, and glass products industries, for which figures are shown in Table 10 and on Chart VI. This group of industries showed slightly more than average increases in both wage earners and horsepower during the first decade of the period under survey. They were apparently affected by the small depression of 1914 and were considerably curtailed in 1919. By 1923, however,

[6] See also Table 11, p. 72.

under the impetus of the great building activity of that period, sharp recovery had taken place in nearly all industries of the group. The rapid growth of the cement industry reflects the increasing use of cement in new buildings and within recent years in road construction. The brick industry has not grown over the period to the same extent as cement, but output of specialized types of brick has

CHART VI.—GROWTH OF MANUFACTURE OF BUILDING MATERIALS: 1899 TO 1925
(1919=100)



increased considerably. The number of wage earners in the glass industry has not increased materially since 1904 and actually decreased between 1919 and 1923. The horsepower of prime movers, however, has shown a substantial increase, and production statistics indicate enlarged output. Apparently this is another case of changed plant technique. The production index for this group of industries demonstrates the extent of depression in building and related industries prevailing in 1919 and 1921. From 1899 to 1919 the increase in the index for this group was much below the average for all industries.[7]

[7] See Table 4, p. 46.

TABLE 10.—STONE, CLAY, AND GLASS PRODUCTS—PER CENT OF INCREASE, FOR CENSUS PERIODS: 1899 TO 1923

INDUSTRY	PER CENT OF INCREASE OR DECREASE (—)					
	24-year period, 1899–1923	Intercensal period				
		1919–1923	1914–1919	1909–1914	1904–1909	1899–1904
INCREASE IN PHYSICAL VOLUME OF PRODUCTION						
Stone, clay, and glass products	131.2	55.6	—11.9	8.8	32.2	17.2
Brick and tile, terra-cotta, and fire-clay products	19.9	54.8	—18.4	—22.7	14.8	7.0
Cement	775.4	70.7	—8.7	33.5	110.3	100.0
Glass	216.7	51.7	—7.0	39.3	22.7	31.3
INCREASE IN AVERAGE NUMBER OF WAGE EARNERS						
Stone, clay, and glass products	50.3	16.6	—10.7	—2.4	20.1	23.1
Glass	38.9	—5.4	4.1	8.1	7.7	21.1
Pottery	119.8	32.1	4.6	----	7.1	19.9
Brick and tile, terra-cotta, and fire-clay products	24.1	34.5	—23.2	30.9	15.9	6.5
Cement	----	37.5	—8.6	4.3	53.2	----
Marble, slate, and stone work	—2.5	24.0	—40.3	—16.3	28.4	22.6
INCREASE IN HORSEPOWER OF PRIME MOVERS						
Stone, clay, and glass products	274.3	21.6	5.3	20.2	60.0	52.1
Glass	354.5	16.0	27.1	32.5	34.6	72.8
Pottery	267.8	53.3	30.2	----	4.9	38.4
Brick and tile, terra-cotta, and fire-clay products	172.3	18.6	—8.4	29.8	33.6	44.5
Cement	----	31.5	—.3	31.9	148.5	----
Marble, slate, and stone work	157.9	26.0	—18.0	10.5	82.4	23.8

The paper and printing group discloses some interesting contrasts. Percentage increases in the average number of wage earners employed, given for four different divisions of the group in Table 11, reveal a greater relative increase in number of wage earners in the paper and wood pulp industry, which produces the basic material for the group, than in the other industries, which are engaged in more advanced phases of manufacture. The relatively slight increase in the average number of wage earners in the printing and publishing trades probably understates substantially the growth of manufacture along these lines. Here, as in certain other lines already pointed out, there have been revolutionary changes in methods of production, with the result that labor has been in considerable measure displaced with machinery. The statistics of horsepower of prime movers indicate that increases in the use of power have been greater in printing and publishing and in the manufacture of paper products than in the paper and wood pulp industry, the reverse of the situation shown by the data on wage earners. Data of newsprint consumed and of the production of various grades of paper used in printing establishments would

suggest a considerably higher proportion of increase than is found in the average number of wage earners. These data were used in the production index and indicate a greater growth in printing and publishing than in paper production.[8]

TABLE 11.—PAPER AND PRINTING—PER CENT OF INCREASE, FOR CENSUS PERIODS: 1899 TO 1923

INDUSTRY	PER CENT OF INCREASE					
	24-year period, 1899–1923	Intercensal period				
		1919–1923	1914–1919	1909–1914	1904–1909	1899–1904
INCREASE IN PHYSICAL VOLUME OF PRODUCTION						
Paper and printing	274.6	37.1	14.3	25.4	34.5	41.8
Paper and wood pulp	239.6	24.3	15.7	23.7	34.5	41.8
Printing and publishing	----------	41.8	11.5	28.5	----------	----------
INCREASE IN AVERAGE NUMBER OF WAGE EARNERS						
Paper and printing	79.1	4.9	12.6	8.9	18.3	17.7
Paper and wood pulp	143.1	6.1	28.6	16.4	15.2	32.9
Boxes, paper and other, not elsewhere specified	105.8	1.9	23.3	14.7	23.2	16.0
Printing and publishing, book and job	94.8	7.1	8.7	4.1	23.9	29.8
Printing and publishing, newspaper and periodical	27.8	.5	5.3	5.2	12.2	2.4
INCREASE IN HORSEPOWER OF PRIME MOVERS						
Paper and printing	200.7	16.9	14.5	22.6	28.0	43.2
Paper and wood pulp	186.1	17.8	14.2	24.3	19.3	43.5
Boxes, paper and other, not elsewhere specified	567.6	12.8	43.9	63.7	54.3	62.8
Printing and publishing, book and job	313.6	15.9	15.5	17.1	78.6	52.0
Printing and publishing, newspaper and periodical	190.6	4.8	6.6	4.8	83.4	35.3

It is interesting to observe that the increase of wage earners in the paper-box industry during the 24-year period 1899–1919, and particularly from 1919 to 1923, was greater than that for wooden packing cases. Growth in these industries, taken together, may be supposed to reflect the same underlying factor; namely, the increase of trade and the corresponding increase in the demand for materials for conveyance, and their divergence indicates, as was pointed out above, the substitution of paper for wood.

By far the most striking industrial changes of the past decade have occurred in the shipbuilding industry. Changes in the average number of wage earners employed in both steel and wooden shipbuilding are given in Table 13. From 1899 to 1914, wooden shipbuilding exhibited an uninterrupted decadence.

[8] See p. 111, Appendix A.

Steel shipbuilding showed declines for the period 1904–1909 and only moderate increases for the other two quinquennial periods. In striking contrast, in the period 1914–1919 the average number of wage earners employed in steel shipbuilding increased 927 per cent and in wooden shipbuilding, 296 per cent. The shipbuilding program of the Federal Government clearly brought a tremendous shifting of labor and capital into this industry. Similar changes were noted in the rated horsepower of machines in the industry and in the production of ships. The number and gross tonnage of new vessels launched in census years from 1899 to 1923 are as follows:

TABLE 12.—VESSELS OF 5 GROSS TONS AND OVER LAUNCHED: 1899 TO 1923

CENSUS YEAR	STEEL		WOODEN	
	Number	Gross tonnage	Number	Gross tonnage
1923	289	281,316	527	112,807
1921	387	1,206,866	438	119,019
1919	1,095	3,734,201	938	755,008
1916	230	485,860	1,147	248,248
1914	126	242,959	987	182,101
1909	158	254,986	1,426	212,233
1904	152	328,411	1,962	350,114
1899	134	262,516	1,947	424,643

These figures and those for wage earners and horsepower definitely indicate that the phenomenal increase of manufacture in this industry between 1914 and 1919 was merely a war episode, as output by 1923 was back at approximately the pre-war level. The readjustment in industry caused by these great and unusually rapid shifts was tremendous. Expensive plants were built for the purpose, and workers were drawn from other industries. The postwar adjustment was effected by the conversion of many plants to other industries, and reports at the census of 1923 indicate that a large part of the total value of work done by establishments engaged in shipbuilding was in repair work rather than in the building of new ships. Other industries and, probably to a large extent, other types of building construction have absorbed the workers left unemployed by the curtailment of shipbuilding.

TABLE 13.—SHIPBUILDING INDUSTRY—PER CENT OF INCREASE, FOR CENSUS PERIODS: 1899 TO 1923

INDUSTRY	PER CENT OF INCREASE OR DECREASE (−)					
	24-year period, 1899–1923	Intercensal period				
		1919–1923	1914–1919	1909–1914	1904–1909	1899–1904
INCREASE IN PHYSICAL VOLUME OF PRODUCTION						
Ship and boat building	−12.2	−92.1	1,269.9	1.4	−28.0	11.1
Steel shipbuilding	7.2	−92.5	1,437.0	−4.7	−22.4	25.1
Wooden shipbuilding, including boat building	−73.4	−85.1	314.9	−14.2	−39.4	−17.6
INCREASE IN AVERAGE NUMBER OF WAGE EARNERS						
Ships, wooden and steel	33.2	−83.9	770.5	9.9	−20.3	8.8
Steel shipbuilding	68.1	−84.9	926.7	19.1	−23.4	18.9
Wooden shipbuilding, including boat building	−34.5	−76.1	295.5	−11.2	−11.8	11.5
INCREASE IN HORSEPOWER OF PRIME MOVERS						
Ships, wooden and steel	414.1	−42.6	380.1	31.0	12.7	26.4
Steel shipbuilding	622.0	−41.0	468.1	45.1	13.1	31.3
Wooden shipbuilding, including boat building	63.9	−51.9	147.1	4.2	12.1	18.2

Perhaps the most extraordinary contrasts to be found anywhere in the records of manufacture during recent years appear in the group producing vehicles for land transportation. The more important data on these industries are given in Table 14.

TABLE 14.—VEHICLES FOR LAND TRANSPORTATION, PLUS RAILROAD REPAIR SHOPS—PER CENT OF INCREASE, FOR CENSUS PERIODS: 1899 TO 1923

INDUSTRY	PER CENT OF INCREASE OR DECREASE (−)					
	24-year period, 1899–1923	Intercensal period				
		1919–1923	1914–1919	1909–1914	1904–1909	1899–1904
INCREASE IN PHYSICAL VOLUME OF PRODUCTION						
Vehicles	4,434.0	99.5	177.8	130.8	90.0	86.4
Automobiles	116,100.0	132.4	301.6	352.7	450.0	400.0
Railway equipment	44.4	19.0	18.2	38.5	−19.0	−6.6
INCREASE IN AVERAGE NUMBER OF WAGE EARNERS						
Vehicles for land transportation, plus railroad repair shops	245.9	8.6	60.8	24.0	31.9	22.4
Automobiles, plus automobile bodies and parts	18,082.1	18.1	170.0	67.8	528.4	437.7
Cars, electric-railroad, plus electric-railroad repairs	266.7	14.2	13.2	16.2	64.5	49.1
Cars, steam-railroad, plus steam-railroad repairs	172.9	5.3	36.3	21.2	19.9	30.9
Bicycles, motor cycles, and parts	−62.5	−39.6	63.0	50.6	33.7	−81.1
Carriages and wagons, including repairs	−86.3	−56.0	−56.0	−21.4	−13.5	3.9

TABLE 14.—VEHICLES FOR LAND TRANSPORTATION, PLUS RAILROAD REPAIR SHOPS—PER CENT OF INCREASE, FOR CENSUS PERIODS: 1899 TO 1923—Con.

INDUSTRY	PER CENT OF INCREASE OR DECREASE (—)					
	24-year period, 1899–1923	Intercensal period				
		1919–1923	1914–1919	1909–1914	1904–1909	1899–1904
INCREASE IN HORSEPOWER OF PRIME MOVERS						
Vehicles for land transportation, plus railroad repair shops	759.2	40.4	63.7	42.3	81.8	44.6
Automobiles, plus automobile bodies and parts	28,407.5	66.7	213.4	129.9	647.4	219.5
Cars, electric-railroad, plus electric-railroad repairs	540.3	14.5	14.9	7.9	399.2	—9.7
Cars, steam-railroad, plus steam-railroad repairs	666.0	30.8	34.2	43.3	74.6	74.3
Bicycles, motor cycles, and parts	—23.2	2.9	69.2	47.6	3.5	—71.1
Carriages and wagons, including repairs	—50.8	—37.9	—44.9	—5.6	25.0	21.8

No considerable line of manufacture has shown so phenomenal an increase as the manufacture of automobiles. In this trade, between 1899 and 1923, the average number of wage earners employed increased over 18,000 per cent. Further details regarding the growth of the automobile industry are given in Table 15, showing data for census years from 1899 to 1923 for number of cars produced, value added by manufacture, number of wage earners, and primary horsepower. Figures have also been included showing value added by manufacture for each car produced and number of cars produced for each wage earner employed. These show roughly the effects on production technique of increasing output in a newly developing industry.

TABLE 15.—GROWTH OF MOTOR-VEHICLE INDUSTRY (INCLUDING MOTOR-VEHICLE BODIES AND PARTS)

CENSUS YEAR	Number of vehicles produced (thousands of cars)	Value added by manufacture (millions of dollars)	Number of wage earners (in thousands)	Primary horsepower (thousands of horsepower)	Value added per vehicle (in dollars)	Vehicles per wage earner
1925	4,157.8	1,750.5	426.1	1,172.0	421.0	9.76
1923	3,902.4	1,464.9	404.9	898.6	375.4	9.64
1921	1,603.1	758.4	212.8	----------	473.1	7.53
1919	1,893.2	1,139.4	343.1	544.2	601.8	5.52
1914	573.0	276.6	127.1	173.7	482.8	4.51
1909	127.3	117.6	75.7	75.6	923.8	1.68
1904	22.8	16.8	12.0	10.1	736.8	1.90
1899	5.0	2.9	2.2	3.2	580.0	1.56

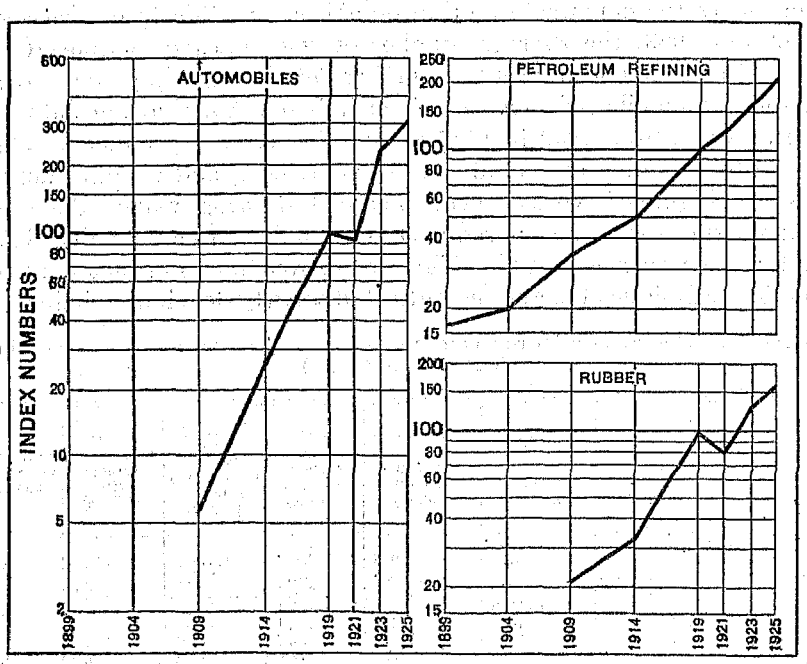
In 1923 seven times as many cars were produced as in 1914 with less than four times as many workers, the number of cars per worker doubling in that period. Most of this increase occurred between 1919 and 1923. Statistics for the motor-vehicle industry from the census of 1925 showed a continuation of this trend at a reduced rate of increase.

From 1921 to 1923 and again from 1923 to 1925, however, the proportion of closed cars, more highly fabricated products, to open cars was rapidly increasing, and consequently the total number of automobiles produced, without regard to type, do not fully reveal the recent changes that have really occurred in the productivity of the industry. The production index, which makes allowances for differences in types of cars, shows increases in output from 1919 to 1923 of 132 per cent and from 1923 to 1925 of 31 per cent, as compared, respectively, with increases of 106 per cent and 7 per cent in number of cars produced. This index is shown on Chart VII.

When the growth of the automobile industry is contrasted with declines in the carriage and wagon industry—87 per cent in number of wage earners employed, 51 per cent in primary horsepower, and

CHART VII.—GROWTH OF MANUFACTURE OF AUTOMOBILES AND ALLIED PRODUCTS: 1899 TO 1925

(1919=100)



85 per cent in number of vehicles produced during the 24-year period—some idea is obtained of the marvelous changes which have been taking place during recent years in land transportation. The number of wage earners employed in the production and repair of steam and electric railway cars has increased at a fairly high rate compared with most other lines of manufacture, but at a rate which

appears low indeed when compared with the growth of automobile production. The sudden collapse in the popularity of the bicycle is shown in the sharp decrease from 1899 to 1904 in the number of wage earners employed in the bicycle and motor-cycle trade. From 1904 to 1919, largely because of the increasing use of the motor cycle, the number of wage earners employed in this line of manufacture increased steadily, but the number employed in 1919 was less than in 1899, and since 1919 the motor cycle has in turn become less popular, owing largely to the lowering of automobile prices to within the range of effective competition. The number of motor cycles and bicycles produced in census years since 1899 is given in Table 37, Appendix B.

Two other industries, which 20 years ago were of relatively little importance, have been stimulated by the growing use of automobiles, and together with the manufacture of motor vehicles have risen to a place among the more important industries. These are petroleum refining and the manufacture of rubber tires and tubes. The percentages of increase in production, in the average number of wage earners employed, and in horsepower installed in these industries during census years are given in Table 16 and indexes of production are shown graphically on Chart VII.

TABLE 16.—RUBBER PRODUCTS AND PETROLEUM REFINING—PER CENT OF INCREASE, FOR CENSUS PERIODS: 1899 TO 1923

INDUSTRY	PER CENT OF INCREASE OR DECREASE (—)					
	24-year period, 1899–1923	Intercensal period				
		1919–1923	1914–1919	1909–1914	1904–1909	1899–1904
INCREASE IN PHYSICAL VOLUME OF PRODUCTION						
All rubber products	----------	30.8	209.6	53.8	----------	----------
Rubber tires and tubes and rubber goods, not elsewhere specified	----------	35.9	311.5	----------	----------	----------
Boots and shoes, rubber	----------	10.3	32.5	----------	----------	----------
Petroleum refining	868.5	62.7	102.4	41.5	74.5	19.0
INCREASE IN AVERAGE NUMBER OF WAGE EARNERS						
All rubber products	277.0	—13.0	114.2	50.3	12.3	20.0
Rubber tires and tubes and rubber goods, not elsewhere specified	389.1	—13.7	127.1	74.8	27.2	12.2
Boots and shoes, rubber	104.4	—10.5	75.9	6.1	—7.3	32.0
Petroleum refining	446.9	13.3	132.2	82.1	—16.9	37.5
INCREASE IN HORSEPOWER OF PRIME MOVERS						
All rubber products: Rubber tires and tubes and rubber goods, not elsewhere specified	1,092.1	44.6	117.5	81.2	59.0	31.6
Boots and shoes, rubber	124.6	13.7	100.6	—4.9	—.7	4.3
Petroleum refining	982.5	63.7	86.0	42.3	96.2	27.4

The physical volume of production of those products used in the operation of automobiles—gasoline and rubber tires—has shown especially rapid growth. Output of fuel oil has also increased, reflecting the growing use of oil-burning machinery.

The contrasts brought out in this chapter are suggestive of the extraordinary complexity of changes in the volume of manufacture. One line of manufacture expands rapidly under the influence of the first widespread introduction of its product; another disintegrates because of the collapse of consumers' demand. Trades, long on the decline, are caught in the whirl of a war program and thrown into unprecedented activity. Others pursue their even course, steadily expanding with the growth of population, through times of war and of peace. The general growth of manufacture merges these diverse conditions into a single composite result. In employing this composite the diversities which lie beneath are not to be forgotten.

IX

THE GROWTH OF MANUFACTURE, BY GEOGRAPHIC DIVISIONS AND STATES

The measurement of industrial expansion thus far undertaken has recognized only distinctions among the several industries without reference to their location. It has paid no attention to variation in the rate of growth in different sections of the country. It seems desirable to consider finally the expansion of manufacturing enterprises, by geographic divisions and in the several States. By this means conclusions may be drawn regarding any observable shifting of manufacturing development from one section to another.

For this purpose changes shown in the average number of wage earners and in primary horsepower are to be considered, as it is not feasible to compute index numbers of the physical volume of production by States or by larger geographic divisions. While, as already recognized, changes in the number of wage earners and in installed horsepower do not accurately represent changes in the physical volume of production, they do serve to show relative rates of expansion or contraction of production among broad groups of manufacturing enterprise. Increases considered by States and still larger geographic divisions rest upon sufficiently broad groups of industries to permit satisfactory comparisons on the basis of changes in number of wage earners and in primary horsepower without primary analysis of other indexes of manufacturing growth.

In estimating industrial expansion for the major geographic divisions, averages of percentage changes in wage earners and horsepower, weighting the figures for wage earners 3 and those for horsepower 1, as given for the country as a whole in Chapter III, will be employed. In making estimates of growth by States, this combination will be shown only for the entire 24-year period, and for individual intercensal periods the wage earners' data alone will be presented. It must be remembered, however, in considering the period from 1919 to 1923 and also to some extent that from 1914 to 1919 that, as was explained in Chapter III, changes in the number of wage earners employed are not strictly representative of the changes in manufacturing output which actually took place in those periods.

Analysis may well begin with a consideration of industrial expansion among the major geographic divisions. This can be followed by a more detailed examination of changes in the growth of manufacture among the several States. That the precise limits of the several geographic divisions may be known, the States comprised in each

are shown below, and the 24 States which in 1923 showed at least 1 per cent of the total number of wage earners are marked with an asterisk:

NEW ENGLAND DIVISION

Maine.
New Hampshire.
Vermont.
Massachusetts.*
Rhode Island.*
Connecticut.*

MIDDLE ATLANTIC DIVISION

New York.*
New Jersey.*
Pennsylvania.*

EAST NORTH CENTRAL DIVISION

Ohio.*
Indiana.*
Illinois.*
Michigan.*
Wisconsin.*

WEST NORTH CENTRAL DIVISION

Minnesota.*
Iowa.
Missouri.*
North Dakota.
South Dakota.
Nebraska.
Kansas.

SOUTH ATLANTIC DIVISION

Delaware.
Maryland.*
District of Columbia.
Virginia.*
West Virginia.
North Carolina.*
South Carolina.*
Georgia.*
Florida.

EAST SOUTH CENTRAL DIVISION

Kentucky.
Tennessee.*
Alabama.*
Mississippi.

WEST SOUTH CENTRAL DIVISION

Arkansas.
Louisiana.*
Oklahoma.
Texas.*

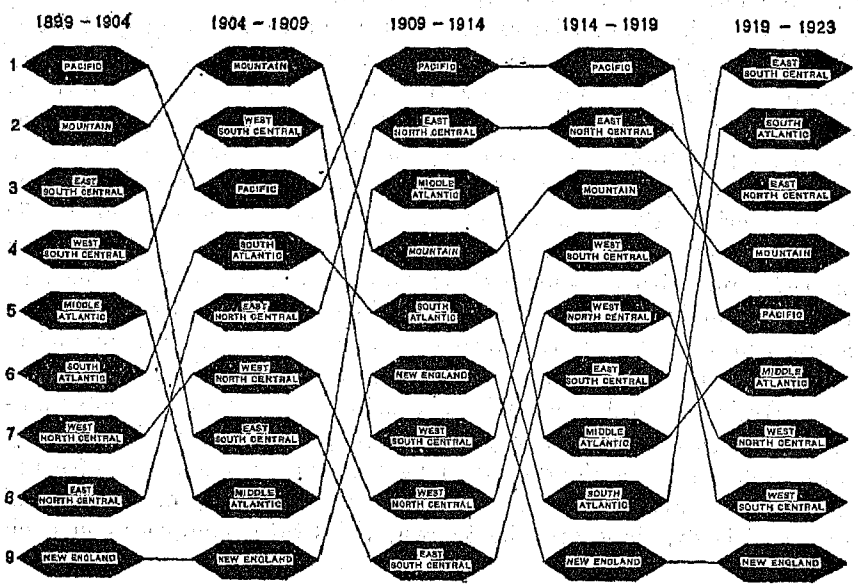
MOUNTAIN DIVISION

Montana.
Idaho.
Wyoming.
Colorado.
New Mexico.
Arizona.
Utah.
Nevada.

PACIFIC DIVISION

Washington.*
Oregon.
California.*

CHART VIII.—RANKING OF GEOGRAPHIC DIVISIONS ACCORDING TO GROWTH OF MANUFACTURE, BY CENSUS PERIODS: 1899 TO 1923



The growth of manufactures, by geographic divisions, for census periods 1899–1923, as indicated by percentage increases in average number of wage earners employed and in primary horsepower installed, and by the combination of these two sets of percentages, appear in Table 17.

Differences among the increases may perhaps be made clearer by ranking the several divisions according to their proportionate increases in each of the intercensal periods. The ranking may be exhibited in two different fashions. These are given in Table 18 and on Chart VIII.

TABLE 17.—GROWTH OF MANUFACTURE, BY GEOGRAPHIC DIVISIONS: 1899 TO 1923

GEOGRAPHIC DIVISION	PER CENT OF INCREASE OR DECREASE (—)					
	24-year period, 1899–1923	Intercensal period				
		1919–1923	1914–1919	1909–1914	1904–1909	1899–1904
United States:						
Wage earners and horsepower combined	116.5	1.1	29.8	9.7	25.1	20.2
Average number of wage earners	88.2	−2.5	29.3	6.4	21.0	16.0
Primary horsepower	229.6	12.8	31.5	20.1	38.5	33.6
New England:						
Wage earners and horsepower combined	65.5	−3.0	19.2	6.3	19.7	12.4
Average number of wage earners	47.7	−6.9	18.5	3.5	17.1	10.4
Primary horsepower	132.8	9.9	21.5	15.1	27.7	18.6
Middle Atlantic:						
Wage earners and horsepower combined	95.9	−1.4	23.3	10.1	20.1	21.9
Average number of wage earners	68.4	−5.9	21.9	6.7	17.0	17.6
Primary horsepower	208.2	13.3	27.4	21.1	30.0	35.6
East North Central:						
Wage earners and horsepower combined	154.8	4.1	42.6	14.0	27.6	17.9
Average number of wage earners	123.1	−.1	42.6	11.0	23.6	14.1
Primary horsepower	279.8	17.9	42.7	23.7	40.4	29.9
West North Central:						
Wage earners and horsepower combined	100.8	−1.7	30.4	4.4	25.9	19.2
Average number of wage earners	78.4	−5.0	30.9	1.9	19.8	17.4
Primary horsepower	186.3	8.7	28.7	12.4	46.2	24.6
South Atlantic:						
Wage earners and horsepower combined	118.8	5.3	20.2	8.2	32.2	20.8
Average number of wage earners	83.5	2.9	19.3	3.4	26.9	14.0
Primary horsepower	270.8	12.9	22.9	24.2	50.0	43.5
East South Central:						
Wage earners and horsepower combined	117.5	6.1	24.0	3.6	22.8	30.0
Average number of wage earners	98.6	6.9	24.5	1.0	18.3	24.8
Primary horsepower	185.6	8.6	22.3	11.7	37.5	46.8
West South Central:						
Wage earners and horsepower combined	156.3	−2.2	31.5	5.3	46.1	29.7
Average number of wage earners	138.0	−5.4	34.6	3.6	42.6	26.5
Primary horsepower	222.3	8.0	22.8	10.6	57.2	39.8
Mountain:						
Wage earners and horsepower combined	208.0	2.2	38.1	9.3	48.3	34.6
Average number of wage earners	141.5	−1.6	34.6	7.5	42.9	18.6
Primary horsepower	539.0	14.5	49.2	14.8	65.7	96.6
Pacific:						
Wage earners and horsepower combined	409.7	−.04	78.4	16.5	39.8	41.1
Average number of wage earners	243.7	−2.7	84.8	10.5	29.9	33.2
Primary horsepower	594.0	8.4	60.6	36.5	74.3	67.6

NOTE.—The percentages shown for wage earners and horsepower combined are weighted geometric averages of the individual percentages for wage earners and for horsepower, with wage earners weighted 3 and horsepower 1.

TABLE 18.—RANKING OF GEOGRAPHIC DIVISIONS ACCORDING TO WEIGHTED AVERAGE OF INCREASES IN NUMBER OF WAGE EARNERS AND IN PRIMARY HORSEPOWER, FOR CENSUS PERIODS: 1899 TO 1923

GEOGRAPHIC DIVISION	1899–1904	1904–1909	1909–1914	1914–1919	1919–1923	Total rank score
Pacific	1	8	1	1	5	11
Mountain	2	1	4	3	4	14
East North Central	8	5	2	2	3	20
West South Central	4	2	7	4	8	25
South Atlantic	6	4	5	8	2	25
East South Central	3	7	9	6	1	26
Middle Atlantic	5	8	3	7	6	29
West North Central	7	6	8	5	7	33
New England	9	9	6	9	9	42

Certain features of the rank lists are striking. One is the rise of the East North Central division from a relatively low position in the first intercensal period to near the top of the list in the period from 1909 to 1923. The rather radical changes in ranking in the latest period, 1919–1923, are especially notable. The Pacific and Mountain divisions which in earlier years were consistently near the top in rate of growth were moved down to the middle of the list, while the East South Central and South Atlantic divisions which were near the bottom from 1909 to 1919 rose to first and second places. The tendency of the New England, West North Central, and Middle Atlantic divisions to occupy positions toward the foot of the rank list is also to be noted; two of these are old established manufacturing sections which passed through their stages of rapid expansion several decades ago, and the third is largely dominated by agricultural States, most of which have had little manufacturing development.

The changes in the years since 1899 may be effectively summarized by considering the combined increases in the average number of wage earners and primary horsepower for the full 24-year period 1899–1923. These increases appear in the first column of Table 17. Despite certain irregularities from one intercensal period to another, it is clear that the most rapid growth of manufacture has been in the Pacific, the Mountain, the West South Central, and the East North Central divisions. The South Atlantic and East South Central divisions, owing to rapid growth between 1919 and 1923, also show, for the full 24-year period, slightly larger increases than the average for the country as a whole. Expansion in the West North Central, Middle Atlantic, and New England States has been below the nation-wide average. New England has shown by far the smallest increase for the full 24-year period and also ranked lowest in rate of increase in every intercensal period shown except one.

Changes in the average number of wage earners among the several States are given in full in Table 19.[1] Differences in industrial expansion from State to State are most effectively shown in a series of

[1] The actual numbers of wage earners reported for the different States are given in Table 35, p. 178.

statistical maps, pages 87 to 89, exhibiting relative increases in the average number of wage earners for the intercensal periods and for the 24-year period 1899–1923.

TABLE 19.—PER CENT OF INCREASE IN AVERAGE NUMBER OF WAGE EARNERS, FOR CENSUS PERIODS, BY STATES: 1899 TO 1923

STATE	PER CENT OF INCREASE OR DECREASE (—)					
	24-year period, 1899–1923	Intercensal period				
		1919–1923	1914–1919	1909–1914	1904–1909	1899–1904
UNITED STATES	88.2	—2.5	29.3	6.4	21.0	16.0
NEW ENGLAND:						
Maine	20.1	—5.3	7.9	2.7	6.7	7.2
New Hampshire	11.6	—9.1	5.2	.4	20.3	—3.4
Vermont	10.3	—7.2	2.4	—3.2	2.1	17.5
Massachusetts	52.5	—6.4	17.7	3.8	19.7	11.4
Rhode Island	53.2	—3.3	23.3	—.1	16.7	10.3
Connecticut	65.1	—9.9	29.3	7.3	16.1	13.7
MIDDLE ATLANTIC:						
New York	59.0	—5.9	16.1	5.4	17.2	17.9
New Jersey	109.9	—11.7	36.2	14.5	22.5	24.5
Pennsylvania	65.6	—3.2	22.9	5.3	15.0	15.0
EAST NORTH CENTRAL:						
Ohio	127.7	—4.0	43.2	14.2	22.7	18.2
Indiana	110.7	5.5	40.5	5.6	21.3	10.9
Illinois	94.6	—.8	28.8	8.8	22.8	14.0
Michigan	223.7	7.0	73.8	17.1	32.1	12.5
Wisconsin	81.0	—5.7	35.8	6.4	20.6	10.1
WEST NORTH CENTRAL:						
Minnesota	62.4	—9.3	24.5	9.5	21.7	7.9
Iowa	77.3	—2.2	27.6	2.4	24.6	11.4
Missouri	84.4	1.8	28.2	—.5	14.9	23.6
North Dakota	174.0	—16.8	36.5	17.4	58.9	29.2
South Dakota	141.9	—15.7	68.5	5.2	44.5	12.0
Nebraska	70.0	—13.1	45.2	3.3	20.1	8.5
Kansas	90.9	—15.2	48.0	—6.7	24.3	31.2
SOUTH ATLANTIC:						
Delaware	13.0	—20.0	31.1	4.3	15.0	—10.1
Maryland	37.7	—7.6	25.8	3.4	14.6	(1)
District of Columbia	60.3	—5.9	18.1	15.2	22.4	2.3
Virginia	71.4	—4.9	16.1	—2.7	31.6	21.2
West Virginia	160.8	3.9	16.8	11.2	46.0	32.3
North Carolina	143.3	11.6	15.2	12.7	42.3	18.0
South Carolina	107.5	22.8	10.6	—1.5	22.9	26.4
Georgia	66.9	12.7	18.2	—.1	12.8	11.3
Florida	84.8	—11.9	33.8	—3.2	36.5	18.7
EAST SOUTH CENTRAL:						
Kentucky	50.8	12.5	7.4	—1.2	9.4	15.6
Tennessee	135.1	13.5	27.9	.7	21.9	31.8
Alabama	96.4	—3.4	36.1	9.1	16.0	18.0
Mississippi	106.0	—4.1	23.2	—7.3	30.2	44.4
WEST SOUTH CENTRAL:						
Arkansas	43.9	—9.2	19.0	—6.7	35.9	5.0
Louisiana	132.9	—3.1	26.5	2.0	36.4	36.6
Oklahoma	985.5	—12.4	69.1	32.7	140.9	129.1
Texas	167.9	—3.8	43.6	6.6	43.1	27.1
MOUNTAIN:						
Montana	64.5	—5.5	25.2	17.6	30.1	—9.1
Idaho	967.1	19.0	56.0	8.5	168.5	97.2
Wyoming	270.3	15.0	121.9	4.3	56.3	—11.0
Colorado	62.2	—10.3	29.2	—2.8	28.7	11.9
New Mexico	123.7	—2.9	51.9	—8.9	19.1	39.7
Arizona	190.8	6.6	23.6	7.1	34.4	53.3
Utah	197.4	—14.7	35.8	17.9	46.4	48.8
Nevada	831.3	50.5	—14.7	61.9	181.4	59.1
PACIFIC:						
Washington	255.5	—15.7	97.8	—2.8	52.9	43.4
Oregon	336.2	7.7	103.1	.3	55.2	28.1
California	220.6	1.6	74.7	21.0	14.9	30.0

[1] Less than one-tenth of 1 per cent.

Contrasts among the different States may be shown in a still different way by ranking the States according to the increases in the number of their wage earners in each intercensal period. The analysis here need hardly concern itself with all the States, but may be advantageously confined to the 24 States which had in 1923 at least 1 per cent of the total number of wage earners in the country. Table 20 and Chart IX show in two different ways for each intercensal period the rankings of these 24 States according to the increases in their wage-earning population.

TABLE 20.—RANKING OF 24 LEADING MANUFACTURING STATES ACCORDING TO INCREASE IN AVERAGE NUMBER OF WAGE EARNERS, FOR CENSUS PERIODS: 1899 TO 1923

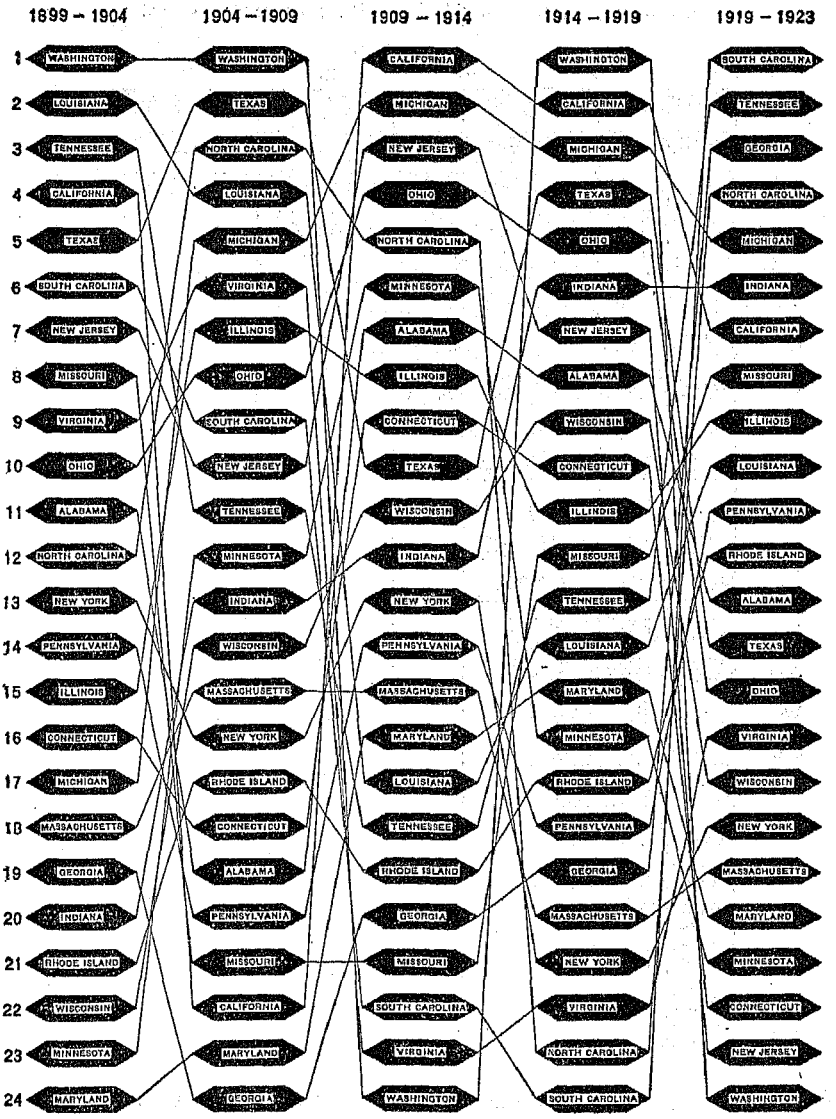
STATE	1899–1904	1904–1909	1909–1914	1914–1919	1919–1923	Total rank score
Michigan	17	5	2	3	5	32
Texas	5	2	10	4	14	35
California	4	22	1	2	7	36
Ohio	10	8	3	7	15	43
Louisiana	2	4	17	14	10	47
North Carolina	12	3	5	23	4	47
Tennessee	3	11	18	13	2	47
New Jersey	7	10	3	7	23	50
Illinois	15	7	8	11	9	50
Washington	1	1	24	1	24	51
Indiana	20	13	12	6	6	57
Alabama	11	19	7	8	13	58
South Carolina	6	9	22	24	1	62
Missouri	8	21	21	12	8	70
Wisconsin	22	14	11	9	17	73
Connecticut	16	18	9	10	22	75
Virginia	9	6	23	22	16	76
Pennsylvania	14	20	14	18	11	77
Minnesota	23	12	6	16	21	78
New York	13	16	13	21	18	81
Georgia	19	24	20	19	3	85
Rhode Island	21	17	19	17	12	86
Massachusetts	18	15	15	20	19	87
Maryland	24	23	16	15	20	98

Marked differences in rates of growth among the various States are to be noted in the postwar as compared with the war and pre-war periods, and consequently, as in the case of the geographic divisions, the accompanying table shows that some noteworthy changes in the ranking of the States have occurred. The consistent rise of Michigan to a place near the top of the list is significant, and California has maintained a high position, but Washington, Texas, New Jersey, and Ohio, which until 1919 have been among the States showing the most rapid increases, ranked below half of the States in rate of increase in wage earners from 1919 to 1923. In the positions formerly occupied by these States, were South Carolina, Tennessee, Georgia, and North Carolina.

The situation among the 24 leading manufacturing States may be differently summarized by showing increases in number of wage

earners for the full 24-year period 1899–1923. The results are shown on Chart X. Despite the small postwar growth, Washington, Texas, Ohio, and New Jersey maintained positions for the entire 24-year

CHART IX.—RANKING OF 24 LEADING STATES ACCORDING TO INCREASE IN AVERAGE NUMBER OF WAGE EARNERS, BY CENSUS PERIODS: 1899 TO 1923

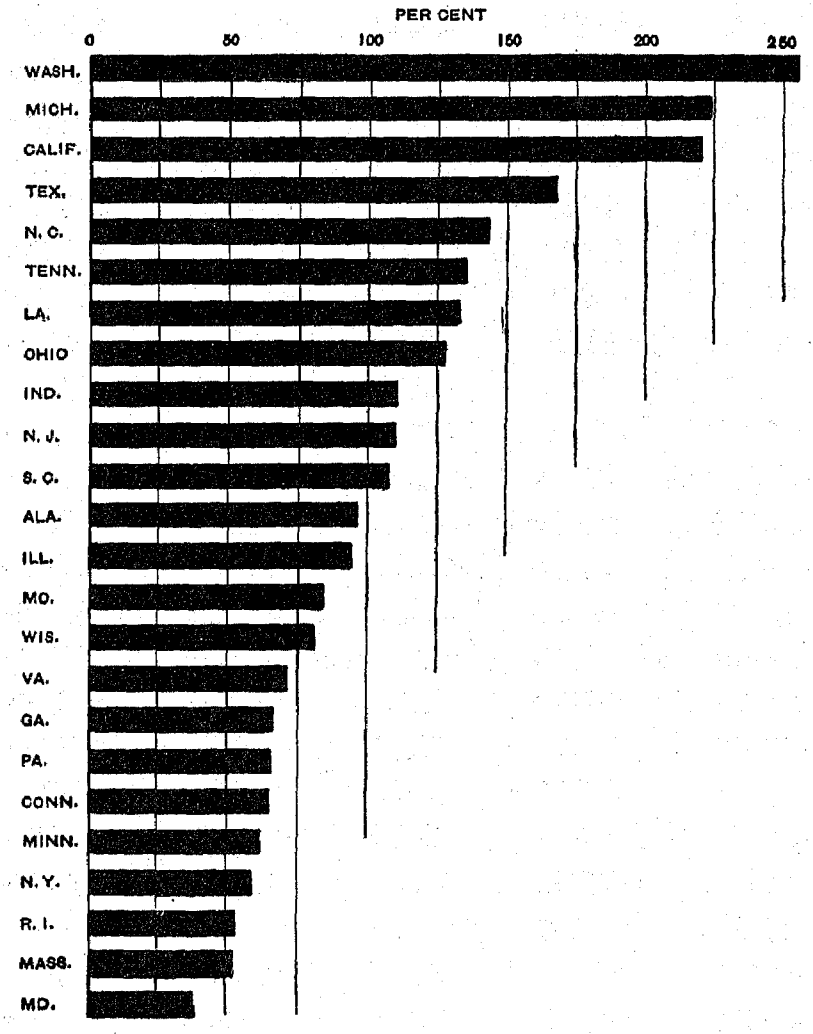


period near the top of the list. California and Michigan, which have continued to increase, and the Southeastern States, which have risen to the top since the war, also rank high. Maryland, Massa-

chusetts, Rhode Island, and New York have remained consistently near the bottom of the list.

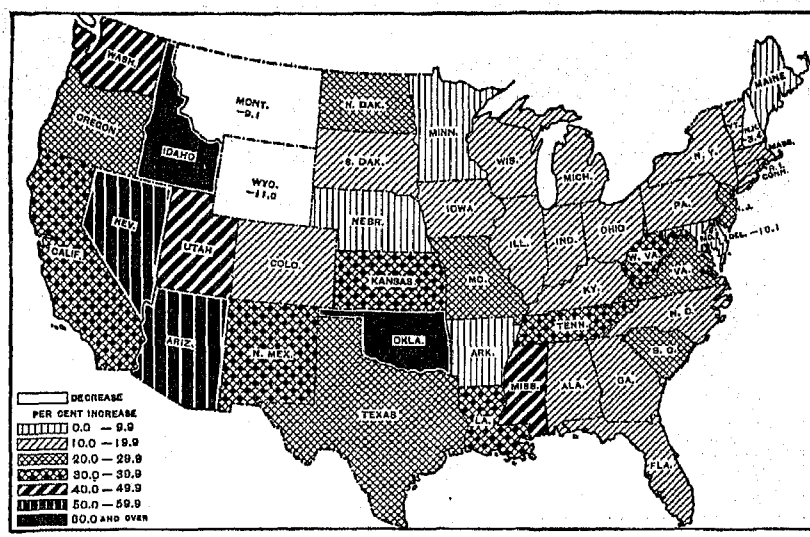
From the data as a whole, it is obvious that the most notable expansion in the 20-year period from 1899 to 1919 occurred on the

CHART X.—INCREASE IN AVERAGE NUMBER OF WAGE EARNERS IN 24 LEADING STATES, FOR 24-YEAR PERIOD: 1899 TO 1923

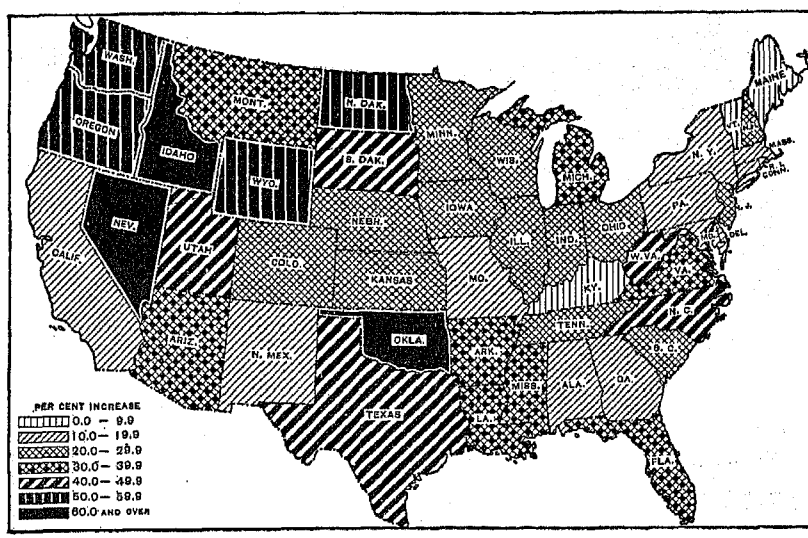


Pacific coast, in the Southwest, and in the North Central region about the Great Lakes. In the Southern States substantial increases were noted prior to 1909, but in the following 10 years other sections showed greater advances. Since 1919, however, the expansion in the new industrial South has been the dominant feature of the growth

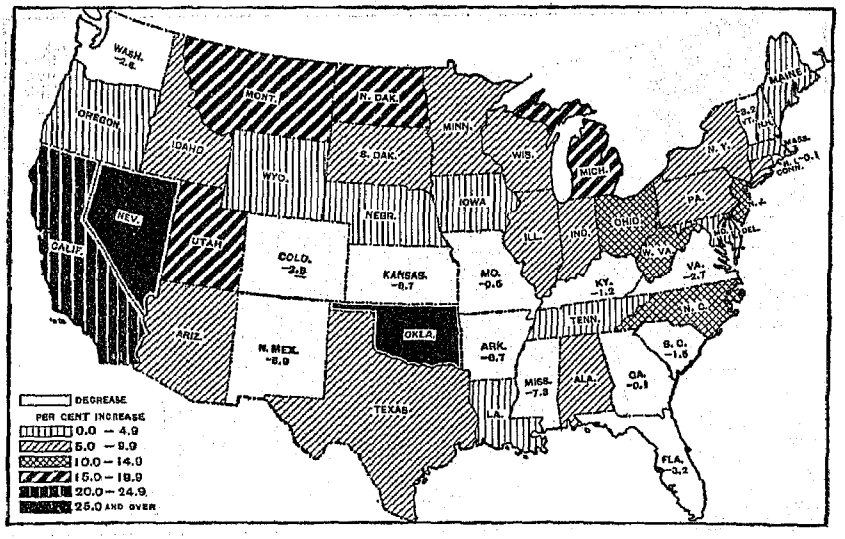
MAP I.—INCREASE IN AVERAGE NUMBER OF WAGE EARNERS, BY STATES: 1899 TO 1904



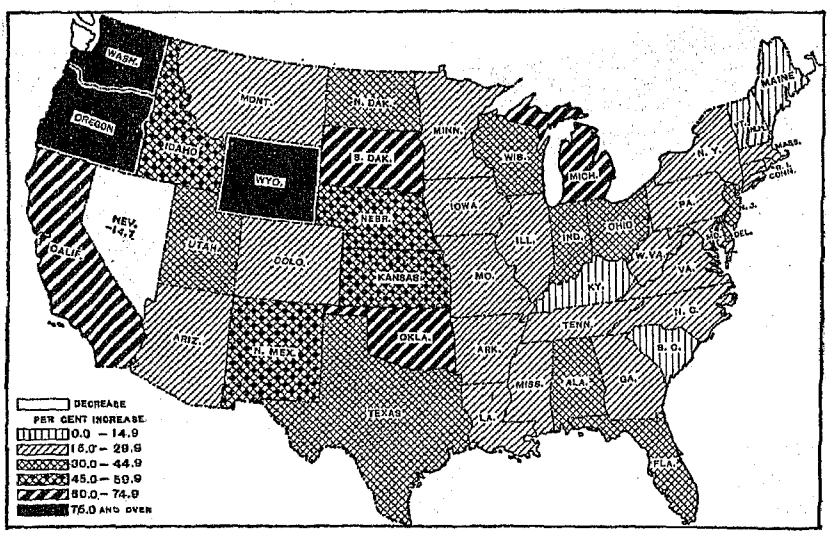
MAP II.—INCREASE IN AVERAGE NUMBER OF WAGE EARNERS, BY STATES: 1904 TO 1909



MAP III.—INCREASE IN AVERAGE NUMBER OF WAGE EARNERS, BY STATES: 1909 TO 1914

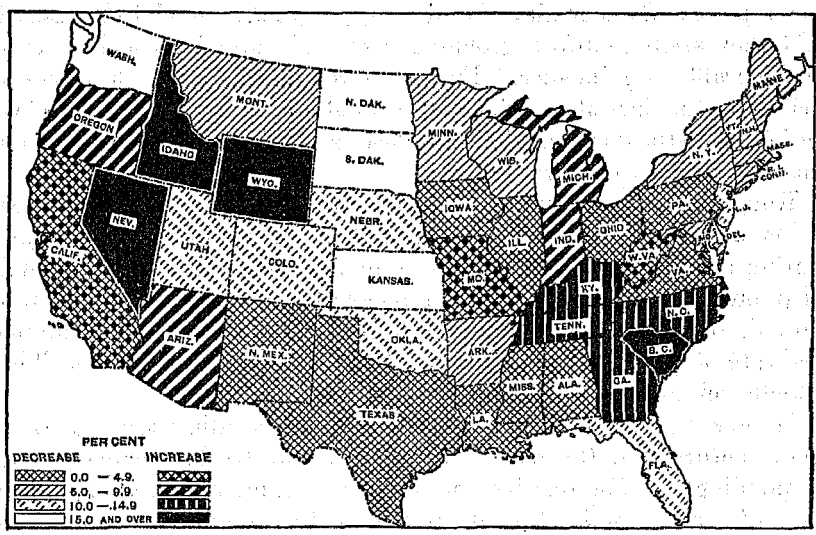


MAP IV.—INCREASE IN AVERAGE NUMBER OF WAGE EARNERS, BY STATES: 1914 TO 1919



for the country as a whole. Part of these changes reflect little more than general economic development of the sections in question. Part, however, evidence a virtual shifting of manufacturing enterprise into new sections. This is particularly true of the East North

MAP V.—INCREASE IN AVERAGE NUMBER OF WAGE EARNERS, BY STATES: 1919 TO 1923



Central States and the new industrial South. It will be most interesting to follow the further course of these new developments. They seem at this time to foreshadow the relative decrease in importance of the older manufacturing sections of the country, and the rapid approach to industrial maturity of sections which only recently were not seriously regarded in the affairs of manufacturing enterprise in this country.

X

GENERAL CONCLUSIONS

The results of the present study may appear to some readers incomplete and uncertain. Admittedly, they leave much to be desired. Yet they seem to afford ground for several tentative conclusions of considerable significance. Furthermore, the analysis has shown definitely the lines along which additional information is most needed. Before the study is brought to a close, a brief consideration of these matters seems worth while.

Rough as the measurement of industrial expansion has had to be, it leaves no doubt concerning the fact of a large increase of output during recent years. This increase has exceeded greatly the growth of population; in fact, it would appear safe to state that the rate of growth of manufacture from 1899 to 1923 was more than double the rate of growth of population. This is perhaps the most striking conclusion to be drawn from the analysis.

It does not follow from this conclusion regarding the growth of manufacture that the real income of the country has increased correspondingly. The real income of the community depends upon the flow of certain kinds of goods, not upon the volume of manufacture of goods in general. To what extent does the analysis throw light upon the character of the enlarged output now being placed at the community's disposal? How has the increase in the output of consumers' goods compared with the increase of goods in general?

Conclusions here can not be as definite as they can be regarding the total growth of manufacture. Yet certain facts are fairly clear. In general, industrial expansion has been most rapid in lines producing industrial apparatus and equipment. True, the manufacture of automobiles and of a few comparatively new lines of consumption goods, such as phonographs, has exhibited an even more rapid increase. But these are hardly to be viewed as general lines of manufacture. Among the general industrial groups, those fabricating iron and steel, the nonferrous metals, and chemicals and allied materials show the largest gains. Undoubtedly this is due in part to the ease with which the sources of raw materials in these groups are exploited. (Consider, in contrast, the restrictions forced upon expansion in the lumber trade by the gradual depletion of our timber resources.) But quite apart from this influence is the underlying tendency toward greater industrialization in current production. We resort increasingly to the factory, and within the factory, increasingly to the machine. Inventions, technical improvements, new

industrial processes make for continual change. Labor is displaced by machinery; old machines are replaced with new—all of which calls for larger and larger output of industrial materials and equipment. Along these lines the most rapid growth of manufacture during recent years is to be found.

But if the increase in the output of consumers' goods has not been as great, it appears, nevertheless, to have exceeded the growth of population during the same period. If attention is focused upon the various lines of manufacture turning out staple consumers' goods, increases during the period 1899–1923 will nearly all be found to be between 50 and 100 per cent. The growth of population for the same period was about 50 per cent. Undoubtedly some lines of manufacture did no more than keep pace with the increase of population. Others, under the influence of declining consumers' demand, failed to expand even this much, or even fell off materially. Furthermore, even in those cases in which manufacture appears to have exceeded the growth of population, we may be dealing with increasing fabrication and not altogether with increasing output. The situation is undoubtedly somewhat obscure. But, upon the whole, the evidence seems to justify the conclusion that the increase in the production of consumers' goods from 1899 to 1923 was considerably in excess of the growth of population during the same period. In other words, there was an increase in the real income per capita in this country during the quarter century ended in 1923.

In view of the importance of the subject, it is regrettable that no more exact and detailed conclusions are to be drawn from the analysis. Inadequacy of the available data has been one of the most conspicuous handicaps of the present investigation. It is to be hoped that some of these deficiencies may in time be remedied. In order that this result may be expedited, some of the lines along which additional information is most needed may well be pointed out.

In the first place, it should be practicable to collect more data on materials consumed and goods produced in manufacturing establishments.[1] The possibility of assembling such information should be carefully canvassed by the census authorities in consultation with competent parties engaged in the several trades. It is obviously unwise to attempt any complete registration or count of the infinite variety of goods produced in current manufacture in this country. But a considerable number of fairly homogeneous products should be selected and followed consistently from one census to another, and special attention should be devoted to those staple commodities which, because of their basic or key positions, reflect the volume of production over wider fields. Much can be done in these directions if the subject is given careful and sustained attention.

[1] Omission from the biennial censuses of inquiries concerning materials consumed is particularly unfortunate.

In the second place, certain unusual situations may well be made objects of special inquiry. If a particular line of manufacture is showing unusual expansion under some specific influence and the nature of the product permits of a study of physical output, much may be learned from a more intensive investigation of the industry. If the production of butter, for instance, appears to be shifting from the farm to the factory, let this be made a matter of special inquiry, perhaps through the Departments of Agriculture and Commerce acting jointly; if the manufacture of bicycles is threatened with sudden collapse, let special data be collected in the trade, that the course of events may be followed more closely. Knowledge of these special cases should be of material assistance in the more general studies of manufacturing growth.

In the third place, studies may be undertaken of the relationship of physical output to the number of wage earners employed and primary horsepower used in the producing establishments. Undoubtedly these relationships differ widely from plant to plant. Furthermore, changes in output may or may not be accompanied by corresponding changes in working forces or installed horsepower. Yet in the number of wage earners and the amount of primary horsepower we have the most general indexes of productive capacity. The extent to which changes in these indirect indexes may be utilized in estimating changes in industrial output should, if possible, be ascertained. Certainly the subject would seem to merit some special attention.

It may seem to some that these suggestions do not promise results substantial enough to warrant additional expenditure. The Federal census of manufactures is already a complicated and expensive statistical inquiry. It would be easy to retort that certain parts of the usual manufacturing schedule are of no value at all—as long contended by the census authorities themselves—and that these might be omitted to make way for those suggested without net increase in the census expenditure. But, in the opinion of the writers, information regarding the growth of manufacture is to be sought quite apart from action taken with regard to other sections of the usual census of manufactures. As pointed out at the very beginning of this monograph, changes in industrial output possess exceptional significance from several points of view. In particular, such changes should be noted with the utmost care because of the light they throw on changes in the size and composition of the real income of the country. Because of the far-reaching importance of this subject, measurement of the growth of manufacture should constitute one of the permanent objects of inquiry of the Federal Bureau of the Census.